Maryland Stadium Authority

Request for Proposals
Testing and Inspection Services
Arthur Perdue Stadium Improvements

Date: September 19, 2024

NOTICE

Minority Business Enterprises are encouraged to respond to this Request for Proposal. Please refer to Section 1.20 of this RFP for information regarding the MBE submission and compliance requirements.

KEY INFORMATION SUMMARY SHEET

MARYLAND STADIUM AUTHORITY

Request for Proposals
Testing and Inspection Services
Arthur Perdue Stadium Improvements

RFP Issue Date:	**September 19, 2024**
Procurement Officer:	**Christian Kramer** Maryland Stadium Authority 351 West Camden Street, Suite 300 Baltimore, Maryland 21201 Phone: 443-202-3885 E-mail: ckramer@mdstad.com
Procurement Method:	**Competitive Sealed Proposals**
MBE Participation Goal:	**10% overall with no sub-goals**
Pre-Proposal Conference:	**September 25, 2024, at 12:00 p.m. Local Time** Registration link: https://us02web.zoom.us/meeting/register/tZErdO6oqj8jGdGswVLdLN9McEqZTzwgM2Zi
Question Due Date:	**September 30, 2024, at 1:00 p.m. Local Time** Submission link: https://mdstad.sharefile.com/r-r0f6478f0b5754bb9a4ae56d00a7fac4b
Proposal Closing Date and Time:	**October 9, 2024, at 1:00 p.m. Local Time** **Technical Proposal Submission link:** https://mdstad.sharefile.com/r-r7a67b0424a93485694f9a953ee1efcca **Financial Proposal Submission link:** https://mdstad.sharefile.com/r-r36de856c9f0d407a960b0b3df4a20d5d

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SECTION 1

GENERAL INFORMATION

1.1 Summary Statement

The Maryland Stadium Authority ("MSA") is issuing this Request for Proposals ("RFP") to select a firm to provide testing and inspection services for the Arthur Perdue Stadium Improvements project ("Project"). Wicomico County ("County" or "Client") has engaged MSA to oversee and manage the improvements to the player development related functions of the Arthur Perdue Stadium located in Salisbury, Maryland.

The project is being designed and built under a Guaranteed Maximum Price ("GMP") via the Design-Build delivery method.

1.2 Abbreviations and Definitions

For purposes of the RFP, the following abbreviations and terms have the meanings indicated below:

a. Agreement – The written contract ("Contract") entered into by MSA and the selected Offeror responding to this RFP. The Agreement will include all MSA general terms and conditions, and will incorporate the entire RFP, including any addenda, and all or indicated portions of the selected Offeror's proposal. For the purpose of this RFP, the terms Agreement and Contract are used interchangeably. A sample of the Agreement is attached to this solicitation as **Attachment L**.

b. Client – Wicomico County.

c. COMAR – Code of Maryland Regulations (available at https://dsd.maryland.gov/Pages/default.aspx).

d. Contract – see Agreement.

e. Contract Administrator ("CA" or "Contract Manager") – The MSA representative for this Agreement that is primarily responsible for contract administration functions, including issuing written direction, monitoring this Contract to ensure compliance with the terms and conditions of the Contract, and to assist the consultant in achieving on budget, on time and on target (e.g., within scope) completion of the Contract requirements. MSA may change the CA at any time by written notice to the Consultant. For the purpose of this RFP the terms Contract Administrator and Contract Manager are used interchangeably.

f. Consultant – The Offeror selected under this RFP.

g. Design Builder ("DB") – A third party engaged by MSA to provide preconstruction and construction management services. The DB is Gilbane Building Company, and the Architect of Record is Ewing Cole.

a. eMMA – eMaryland Marketplace Advantage (available at https://emma.maryland.gov).

b. Key Personnel – All Contractor Personnel identified in the solicitation and the Offeror's Proposal that are essential to the work being performed under the Contract.

c. Local Time – Time in the Eastern Time Zone as observed by the State of Mayland.

d. MBE – Minority Business Enterprise certified by the Maryland Department of Transportation ("MDOT").

e. MSA – Maryland Stadium Authority (available at https://mdstad.com/).

f. MSA Business Hours – 8:30 A.M. to 5:00 P.M., local time, Monday through Friday, excluding State holidays or State closures.

g. MSA Procurement Policies – MSA procurement policies and procedures (available at https://mdstad.com/doing-business/contract-opportunities or may be obtained by contacting the Procurement Officer.).

h. Notice to Proceed ("NTP") – A formal notification issued by the Procurement Officer that directs the successful Offeror to perform work and establishes the date on which the work is to commence on the Project.

i. Offeror – An individual or entity, regardless of legal status or organization, which submits a Proposal in response to this RFP. The Offeror is the individual or entity that will be executing the Contract with MSA.

j. Owner – Maryland Stadium Authority.

k. Procurement Officer ("PO") – The MSA representative responsible for this RFP.

l. Project – Arthur Perdue Stadium Improvements.

m. Project Manager ("PM") – The MSA representative primarily responsible for monitoring the daily activities associated with, and providing technical guidance for the Project. The Project Manager is the point of contact, post-award, who will assign work and to whom invoices will be submitted.

n. Project Team – Includes MSA, the Client, the Design-Build team, the successful Offeror selected in response to this RFP, and any other consultant or entity MSA may engage to participate in the Project.

o. Proposal – The submissions provided by an Offeror in response to this RFP, including, but not limited to, the Technical Proposal, oral presentation materials, Financial Proposal and any technical clarifications and Best and Final Offer ("BAFO"), or other information that may be requested by the Procurement Officer.

p. Proposal Closing Date and Time – as identified in the Key Information Summary Sheet of the RFP or as amended via addendum.

q. Request for Proposals ("RFP") - This procurement solicitation, as amended.

r. Selection Committee - The persons evaluating the Proposals, and recommending to the Procurement Officer which Offeror to select as the apparent awardee.

s. State – The State of Maryland.

1.3 Agreement Type

The Agreement that results from this RFP will be for a not-to-exceed amount, which will include an Owner's contingency. The Owner's contingency will be used at Owner's sole discretion. The Contract amount shall not be exceeded without the necessary contract modification.

1.4 Agreement Duration

The term of the Agreement will be for a period necessary to complete the scope of work, as agreed upon by MSA and the successful Offeror. Please refer to the Project Schedule included in this RFP as **Attachment K**.

1.5 Procurement Officer

The sole point-of-contact for purposes of this RFP is the Procurement Officer listed in the Key Information Summary Sheet.

MSA may change the Procurement Officer at any time and will provide written notice to the Offerors if any such change occurs.

1.6 The Contract and Project Manager

The Contract and Project Manager is:

Christopher Deremeik
Maryland Stadium Authority
351 West Camden Street, Suite 300
Baltimore, Maryland 21201

Prior to contract award, MSA may change the Project Manager at any time and will provide written notice to all potential Offerors. After Contract Award, MSA may change the Project Manager at any time by written notice to the successful Offeror.

1.7 e-Maryland Marketplace Advantage

eMMA is the electronic commerce system for the State of Maryland. In order to receive a contract award, a vendor must be registered on eMMA. Registration is free. You can register at: https://emma.maryland.gov. Click on "New Vendor? Register Now" to begin the process, and follow the prompts.

1.8 Pre-Proposal Conference

A virtual Pre-Proposal Conference ("Conference") will be held on the date and time indicated on the Key Information Summary Sheet.

Please click on the registration link stated on the Key Information Summary Sheet for details regarding the Conference and to RSVP to the event.

1.9 *Reserved*

1.10 Questions

Questions regarding this RFP shall be submitted electronically, in Word or PDF format, via the questions link no later than the date and indicated on the Key Information Summary Sheet.

In the document, include information regarding the name of the firm, representative's name, and contact information. Based on the availability of time to research and communicate an answer, the Procurement Officer will decide whether an answer can be given before the Proposal Closing Date and Time. Answers to all substantive questions that have not previously been answered, and are not clearly specific to the requestor, will be provided via addendum.

1.11 Proposal Closing Date and Time - Technical and Financial Proposals

To be considered, **Technical and Financial Proposals** shall be submitted via their respective ShareFile links no later than on the date and time indicated on the Key Information Summary Sheet. Requests for an extension of this date or time will not be granted.

Proposals not submitted in the manner indicated in this section and the Key Information Summary Sheet will be considered not responsive to this RFP and will be rejected.

Offerors shall allow sufficient electronic transmission time to ensure timely receipt of their proposal. Proposals received by MSA after the Proposal Closing Date and Time are not eligible for being selected for award and will be rejected. Proposals will not be opened publicly.

1.12 Oral Presentations

MSA does not anticipate to conduct oral presentations, but reserves the right to conduct oral presentations or discussions should this be in the best interest of the State. In the event that MSA exercises its right, Offerors will be required to make oral presentations to the Selection Committee. Significant representations made by an Offeror during their oral presentation must be confirmed in writing. All such representations will become part of the Offeror's Proposal and are binding if a Contract is awarded as a result of this RFP.

1.13 Duration of Offer

Proposals submitted in response to this RFP are irrevocable for **180 days** following the closing date for proposals. This period may be extended at the Procurement Officer's request only with the Offeror's written agreement.

1.14 Affidavits

1.14.1 Proposal Affidavit

A completed Bid/Proposal Affidavit must accompany the Proposal submitted by an Offeror. A copy of this Affidavit is included as **Attachment A** of this RFP.

1.14.2 Contract Affidavit

All Offerors are advised that if an Agreement is awarded as a result of this RFP, the successful Offeror will be required to complete a Contract Affidavit. A copy of this Affidavit is included for informational purposes only as **Attachment C** of this RFP. This Affidavit must be provided within five business days after notification of proposed Agreement award.

For purposes of completing Section "B" of the affidavit (Certification of Registration or Qualification with the State Department of Assessments and Taxation), a business entity that is organized outside of the State of Maryland is considered a "foreign" business.

1.14.3 Conflict of Interest Affidavit

A completed Conflict of Interest Affidavit must accompany the Proposal submitted by an Offeror. A copy of this Affidavit is included as **Attachment B** of this RFP.

1.15 Procurement Method

The Agreement resulting from this RFP will be awarded in accordance with the Competitive Sealed Proposals process under Section 3 (C) of MSA's Procurement Policies.

1.16 Arrearages

By submitting a response to this RFP, an Offeror represents that it is not in arrears in the payment of any obligations due and owing the State of Maryland, including, by way of example only, the payment of taxes and employee benefits, and that it will not become so in arrears during the term of the Contract if selected for contract award.

1.17 Revisions to the RFP

1. If it becomes necessary to revise this RFP before the closing date for proposals, an addendum/addenda will be posted on eMMA, Gov Delivery, and MSA's website. Addenda issued after the closing date for proposals will be sent only to those Offerors who submitted a responsive and timely proposal, or, if applicable, Offerors that were short-listed to participate in the next phase of the procurement process.

2. Acknowledgment of the receipt of all addenda to this RFP issued before the proposal closing date must accompany the Offeror's Proposal as identified in Section 4 of the RFP.
3. Acknowledgement of receipt of addenda to the RFP issued after the proposal closing date shall be in the manner specified in the addendum notice.
4. Failure to acknowledge receipt of addenda does not relieve the Offeror from complying with all terms of any such document.

1.18 Cancellations; Discussions

MSA reserves the right to cancel this RFP, to accept or reject any and all proposals, in whole or in part, received in response to this RFP, to waive or permit cure of minor irregularities, and to conduct discussions with any or all qualified or potentially qualified Offerors in any manner necessary to serve the best interests of MSA. This may be followed by submission of Offeror-revised Proposals and BAFOs. MSA also reserves the right, in its sole discretion, to award a contract based upon written proposals received, without prior discussions or negotiations.

1.19 False Statement

MSA incorporates by reference the provisions of Section 11-205.1 of the State Finance and Procurement Article of the Annotated Code of Maryland regarding truthfulness in the information included in the contract documents. Offerors shall comply with the obligations set forth therein, including, without limitation, the following:

1. In connection with a procurement contract, a person may not willfully:
   a. Falsify, conceal, or suppress a material fact by any scheme or device;
   b. Make a false or fraudulent statement or representation of a material fact; or
   c. Use a false writing or document that contains a false or fraudulent statement or entry of a material fact.
2. A person may not aid or conspire with another person to commit an act under subsection of this section.
3. A person who violates any provision of this section is guilty of a felony and on conviction is subject to a fine not exceeding $20,000 or imprisonment not exceeding five (5) years or both.

1.20 Minority Business Enterprise

Minority Business Enterprises are encouraged to respond to this solicitation.

1. An overall MBE subcontractor participation goal as identified in the Key Information Summary Sheet has been established for this procurement, representing a percentage of the total contract dollar value, including all

renewal option terms, if any. MBE goals for the construction phase will be determined prior to the bidding phase. All subcontractors named by the Offeror as part of their MBE Schedule must be certified with the Maryland Department of Transportation (MDOT).

2. Notwithstanding any subgoals established for this RFP, the Contractor is encouraged to use a diverse group of subcontractors and suppliers from any/all of the various MBE classifications to meet the remainder of the overall MBE participation goal.

3. By submitting a response to this solicitation, the Offeror acknowledges the overall MBE subcontractor participation goal and subgoals, and commits to achieving the overall goal and subgoals by utilizing certified minority business enterprises, or requests a full or partial waiver of the overall goal and subgoals.

4. An Offeror that does not commit to meeting the entire MBE participation goal(s) stated in this RFP must submit a request for waiver with its proposal submission that is supported by good faith efforts documentation to meet the MBE goal made prior to submission of its proposal as outlined in **Attachment D-1B**, Waiver Guidance. Failure of an Offeror to properly complete, sign, and submit **Attachment D-1A** at the time it submits its Technical Proposal to the RFP will result in the State's rejection of the Offeror's Proposal. This failure is not curable.

5. If the Offeror fails to properly complete, sign, and submit **Attachment D-1A** at the time it submits its technical Proposal, the Procurement Officer may determine that the Proposal is not reasonably susceptible of being selected for award.

6. Attachments

   a. Minority Business Enterprise instructions and forms are provided in **Attachment D** to assist Offerors.

   b. The Offeror shall include with its Technical Proposal a completed MBE Utilization and Fair Solicitation Affidavit (**Attachment D-1A**) whereby:

      A. The Offeror acknowledges the certified MBE participation goal and commits to make a good faith effort to achieve the goal and any applicable sub-goals, or requests a waiver, and affirms that MBE subcontractors were treated fairly in the solicitation process; and

      B. The Offeror responds to the expected degree of MBE participation, as stated in the solicitation, by identifying the specific commitment of certified MBEs at the time of Proposal submission. The Offeror shall specify the percentage of total contract value associated with each MBE subcontractor identified on the MBE participation schedule, including any work performed by the MBE prime (including a prime participating as a joint venture) to be counted towards meeting the MBE participation goals, each MBE

subcontractor's MDOT certification number and the North American Industry Classification System ("NAICS") code and product and service description of the work to be performed.

C. An Offeror requesting a waiver should review **Attachment D-1B** (Waiver Guidance) and **Attachment D-1C** (Good Faith Efforts Documentation to Support Waiver Request) prior to submitting its request.

D. If the Offeror fails to submit a completed **Attachment D-1A** with the technical Proposal, as required, the Procurement Officer may determine that the Proposal is not reasonably susceptible of being selected for award.

7. Offerors are responsible for verifying that each MBE (including any MBE primes and MBE primes participating in a joint venture) selected to meet the goal and any sub-goals, and subsequently identified in **Attachment D-1A**, is appropriately certified by the Maryland Department of Transportation and has the correct NAICS codes allowing it to perform the committed work.

8. Within ten (10) business days from notification that it is the recommended awardee or from the date of the actual award, whichever is earlier, the Offeror must provide the following documentation to the Procurement Officer:

   a. Outreach Efforts Compliance Statement (**Attachment D-2**);

   b. MBE Subcontractor/Prime Project Participation Certification (**Attachment D-3A/3B**);

   c. A copy of each sub-contract agreement, between the apparent awardee and any proposed MBE sub-contractor that the parties intend to enter into contingent upon the MSA's award of the prime contract. The sub-contract agreement must contain all necessary terms, including pricing, required for the MBE to perform its proposed work and for the apparent awardee to pay the MBE for its work during the term of the agreement; and

   d. Any other documentation required by the Procurement Officer to ascertain Offeror responsibility in connection with the certified MBE subcontractor participation goal or any applicable sub-goals.

   e. Further, if the selected Offeror believes a waiver (in whole or in part) of the overall MBE goal or of any applicable subgoal is necessary, the recommended awardee must submit a fully-documented waiver request that complies with COMAR 21.11.03.11. If the recommended awardee fails to return each completed document within the required time, the Procurement Officer may determine that the recommended awardee is not responsible and, therefore, not eligible for award. If the Project has already been awarded, the award is voidable.

9. A current directory of certified MBEs is available through the Maryland State Department of Transportation (MDOT), Office of Minority Business Enterprise, 7201 Corporate Center Drive, Hanover, Maryland 21076. The phone numbers are 410-865-1269, 1-800-544-6056, or TTY 410-865-1342. The directory is also available on the MDOT website at https://marylandmdbe.mdbecert.com/FrontEnd/searchcertifieddirectory.asp. The most current and up-to-date information on MBEs is available via this website. Only MDOT-certified MBEs may be used to meet the MBE subcontracting goals.
10. An Offeror that requests a waiver of the goal or any of the applicable subgoals will be responsible for submitting the Good Faith Efforts Documentation to Support Waiver Request (**Attachment D-1C**) and all documentation within ten (10) business days from notification that it is the recommended awardee or from the date of the actual award, whichever is earlier, as required in COMAR 21.11.03.11.
11. All documents, including the MBE Utilization and Fair Solicitation Affidavit & MBE Participation Schedule (**Attachment D-1A**), completed and submitted by the Offeror in connection with its certified MBE participation commitment, and all of its amendments, shall be considered a part of the Agreement and are hereby expressly incorporated into the Agreement by reference thereto. All of the referenced documents will be considered a part of the Proposal for order of precedence purposes (see **Attachment L**).
12. The Offeror is advised that liquidated damages will apply in the event the Contractor fails to comply in good faith with the requirements of the MBE program and pertinent contract.

1.21 Incurred Expenses; Economy of Preparation

Neither MSA nor the Client is responsible for any costs incurred by an Offeror in preparing and submitting a proposal, in making an oral presentation, in providing a demonstration or in performing any other activities relative to this RFP. Proposals should be prepared simply and economically, providing a straightforward, concise description of how the Offeror proposes to meet the requirements of this RFP.

1.22 Protests/Disputes

Any protest or dispute related to this RFP will be subject to Section 10 of MSA's Procurement Policies and Procedures and the relevant provisions of the Contract.

1.23 Access to Public Records Act Notice

An Offeror should give specific attention to the clear identification of those portions of the Proposal that it considers confidential and/or proprietary commercial information or trade secrets, and provide written justification why such materials, upon request, should not be disclosed by the State under the Public Information Act, Title 4 of the General Provisions Article of the Annotated

Code of Maryland. This information should be identified by page and section number and placed after the Title Page and before the Table of Contents in the technical Proposal and if applicable, separately in the financial Proposal. Offerors are advised that, upon request for this information from a third party, the Procurement Officer is required to make an independent determination whether the information may be disclosed.

1.24 Offeror Responsibilities

The Offeror shall be responsible for all products and services required by this RFP. Subcontractors must be identified, and a complete description of their roles relative to the Proposal must be included in the Proposal. The Offeror retains responsibility for all work to be performed by and any deliverable submitted by a subcontractor. If an Offeror that seeks to perform or provide the services required by this RFP is the subsidiary of another entity, all information submitted by the Offeror such as, but not limited to, references and financial reports, shall pertain exclusively to the Offeror, unless the parent organization will guarantee the performance of the subsidiary. If applicable, the Offeror's proposal must contain an explicit statement that the parent organization will guarantee the performance of the subsidiary.

1.25 Patents, Copyrights, and Intellectual Property

1. If the Consultant furnishes any design, device, material, process or other item that is covered by a patent or copyright or that is proprietary to or a trade secret of another, it shall obtain the necessary permission or license to permit MSA or the Client to use such item.
2. The Consultant will defend or settle, at its own expense, any claim or suit against MSA and the Client alleging that any such item furnished by the Consultant infringes any patent, trademark, copyright, or trade secret. If a third party claims that a product infringes that party's patent, trademark, copyright or trade secret, the Consultant will defend MSA and the Client against that claim at the Consultant's expense and will pay all damages, costs, and attorneys' fees that a court finally awards, provided MSA and the Client: (i) promptly notifies the Consultant in writing of the claim; and (ii) allows the Consultant to control and cooperates with the Consultant in, the defense and any related settlement negotiations. The obligations of this paragraph are in addition to those stated in the next paragraph.
3. If any products furnished by the Consultant become, or in the Consultant's opinion are likely to become, the subject of a claim of infringement, the Consultant will, at its option and expense: (i) procure for MSA and Client the right to continue using the applicable item; (ii) replace the product with a non-infringing product substantially complying with the item's specifications; or (iii) modify the item so that it becomes non- infringing and performs in a substantially similar manner to the original item.

1.26 Non-Availability of Funding

If the General Assembly fails to appropriate funds or if funds are not otherwise made available for continued performance for any fiscal period of a contract succeeding the first fiscal period, the contract shall be canceled automatically as of the beginning of the fiscal year for which funds were not appropriated or otherwise made available; provided, however, that this will not affect the rights of the Consultant, the MSA and TOC under any termination clause in the contract. The effect of termination of the contract hereunder will be to discharge the Consultant, the MSA and the Client from future performance of the contract, but not from their rights and obligations existing at the time of termination. The Consultant shall be reimbursed for the reasonable value of any nonrecurring costs incurred but not amortized in the price of the contract. The MSA and the Client shall notify the Consultant as soon as it has knowledge that funds may not be available for the continuation of the contract for each succeeding fiscal period beyond the first.

1.27 Financial Disclosure

The Consultant shall comply with Section 13-221 of the State Finance and Procurement Article of the Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State or its agencies during a calendar year under which the business is to receive in the aggregate,

$100,000 or more, shall, within 30 days after the aggregate value of these contracts, leases or other agreements reaches $100,000, file with the Secretary of the State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

1.28 Non-Exclusive Use

Neither this RFP nor any resulting Contract shall be construed to require the MSA to use any Offeror or exclusively use the Consultant for the services described in this RFP. MSA reserves the right to obtain services of any nature from other sources when it is in the best interest of the MSA to do so and without notice to any party. The MSA makes no guarantees that it will purchase any products or services from the Consultant resulting from this RFP.

1.29 Sustainability Policies

MSA is committed to procuring all supplies, services, maintenance, construction, and architect-engineer services in a manner consistent with the promotion of sound environmental practices.

1.30 Payments by Electronic Fund Transfer

By submitting a response to this RFP, the Offeror agrees to accept payments by electronic funds transfer (EFT). A form will be provided to the selected Offeror.

1.31 Confidentiality

Subject to the Maryland Public Information Act and any other applicable laws, all confidential or proprietary information and documentation relating to either party to a Contract resulting from this RFP (including without limitation any information or data stored within the Consultant's computer systems) shall be held in absolute confidence by the other party. Each party shall, however, be permitted to disclose relevant confidential information to its officers, agents, and employees to the extent that such disclosure is necessary for the performance of their duties under the Contract, provided that the data may be collected, used, disclosed, stored, and disseminated only as provided by and consistent with the law. The provisions of this section shall not apply to information that (a) is lawfully in the public domain; (b) has been independently developed by the other party without violation of the Contract; (c) was already in the possession of such party; (d) was supplied to such party by a third-party lawfully in possession thereof and legally permitted to further disclose the information; or (e) such party is required to disclose by law.

1.32 Loss of Data

In the event of loss of any MSA and/or Project related data or records where such loss is due to the intentional act or omission or negligence of the Consultant or any of its sub consultants or agents, the Consultant shall be responsible for recreating such lost data in the manner and on the schedule set by the Project Manager. The Consultant shall ensure that all data is backed up and recoverable by the Consultant.

1.33 Non-Hiring of Employees

No official or employee of the State, as defined in State Government Article,

§ 15-102, Annotated Code of Maryland, whose duties as such official or employee include matters relating to or affecting the subject matter of this procurement, shall, during the pendency and term of a resulting Contract, and while serving as an official or employee of the State, become or be an employee of the Consultant or any entity that is a sub-consultant on Contract.

1.34 Nondiscrimination in Employment

The Consultant agrees: (a) not to discriminate in any manner against an employee or applicant for employment because of race, color, religion, creed, age, sex, marital status, sexual orientation, national origin, ancestry or disability of a qualified individual with a disability; (b) to include a provision similar to that contained in subsection (a) above in any subcontract except a subcontract for standard commercial supplies or raw materials; and (c) to post, and to cause sub consultants to post, in conspicuous places available to employees and applicants for employment, notices setting forth the substance of this clause.

1.35 Contingent Fee Prohibition

The Consultant warrants that it has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson or commercial selling agency working for the Consultant, to solicit or secure an Agreement, and that it has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson or commercial selling agency, any fee or other consideration contingent on the making of an Agreement.

1.36 Political Contribution Disclosure

The Consultant shall comply with Election Law Article, §§14-101 to 14-108, Annotated Code of Maryland, which requires that every person that enters into contracts, leases, or other agreements with the State, a county, or an incorporated municipality, or their agencies, during a calendar year in which the person receives in the aggregate $100,000 or more, shall file with the State Board of Elections a statement disclosing contributions in excess of $500 made during the reporting period to a candidate for elective office in any primary or general election. The statement shall be filed with the State Board of Elections: (1) before a purchase or execution of a lease or contract by the State, a county, an incorporated municipality, or their agencies, and shall cover the preceding two calendar years; and (2) if the contribution is made after the execution of a lease or contract, then twice a year, throughout the contract term, on: (a) February 5, to cover the 6-month period ending January 31; and (b) August 5, to cover the 6-month period ending July 31.

1.37 Verification of Registration and Tax Payment

Before a corporation can do business in the State, it must be registered with the Department of Assessments and Taxation, State Office Building, Room 803, 301 West Preston Street, Baltimore, Maryland 21201. It is strongly recommended that any potential Offeror complete registration prior to the Proposal due date and time. An Offeror's failure to complete registration with the Department of Assessments and Taxation may disqualify an otherwise successful Offeror from final consideration and recommendation for contract award under this RFP.

Prior to contract award under this RFP, the selected firm, including the joint ventures, must be able to provide a Certificate of Good Standing from the Maryland State Department of Assessments and Taxation.

1.38 MBE and Prevailing Wage Compliance System

As part of MSA's commitment to assist firms in complying with legal and contractual requirements, MSA maintains a web-based MBE and prevailing wage compliance system. The system was designed to provide various work-flow automation features that improve the project reporting process. This system will monitor contract compliance for all Program contracts. The prime firm, its first-tier consultants, and all MBE participation subcontractors awarded contracts will

be required to use the web-based system to submit project information including, but not limited to, certification of payments made and received and certified payroll records (if the contract includes prevailing wage and/or workforce development requirements). MSA may require additional information related to the contract to be provided electronically through the system at any time before, during, or after Agreement award.

1.39 Maryland Law

This RFP shall be construed, interpreted, and enforced according to the laws of the State of Maryland.

1.40 Acceptance of Terms and Conditions

By submitting a Proposal, the Offeror accepts all of the terms and conditions set forth in this RFP including all attachments.

Any exceptions to this RFP or the Agreement shall be clearly identified in the Executive Summary of the Technical Proposal, and shall be accompanied by the Offeror's proposed amended language to the requirements in question. All exceptions will be taken into consideration when evaluating the Offeror's Proposal. MSA reserves the right to accept or reject any exceptions.

1.41 Procurement Regulations

The RFP and any Agreements entered into as a result hereof is not subject to the provisions of Division II of the State Finance and Procurement Article of the Maryland Annotated Code (the "Procurement Article") except as set forth in MSA's Procurement Policies.

1.42 Multiple Proposals

MSA will not accept multiple or alternate proposals from a single Offeror.

SECTION 2

OFFEROR QUALIFICATION AND EXPERIENCE

The Offeror shall clearly demonstrate in its Technical Proposal that it meets the qualifications listed below as of the Proposal Closing Date and Time the Offeror. For each listed requirement, the Executive Summary shall include a reference(s) to the page number(s) in the Proposal where such evidence can be found.

Note: Offeror's Proposals that fail to respond to all requirements of this Section may be deemed not reasonably susceptible of being selected for award.

At a minimum the Offeror shall meet the following qualifications to be considered for award:

1. Has been in business for at least five (5) years;
2. Is a firm that is licensed operate in the State of Maryland;
3. Has a minimum of five (5) years of significant experience in providing testing and inspection services. List projects that your firm has performed as a prime consultant that demonstrate how you meet this requirement. You must include all of the following items in your response:
   a. Earthwork/soils;
   b. Asphalt;
   c. Erosion and Sediment Control;
   d. Concrete;
   e. Masonry;
   f. Steel;
   g. Roofing;
   h. Fireproofing/Fire Resistant Materials;
   i. Waterproofing;
   j. Windows and skylights; and
   k. Painting;
4. Is able to provide testing and inspection services in accordance with the applicable codes and practices, including, without limitation, the 2018 International Building Code, American Council of Independent Laboratories, Wicomico County Code, and as specified in the applicable Project construction documents.
5. Offeror shall clearly and accurately demonstrate specialized knowledge and experience in the aforementioned categories, as well as with the requirements for testing and inspections set forth in the 70% Construction Documents (**Attachment J**).

6. Has the ability to meet the insurance coverage requirements stated in the Sample Contract (**Attachment L**).

NOTE: An Offeror meeting these requirements does not guarantee that the Offeror will be deemed responsible or have its Technical Proposal deemed reasonably susceptible of being selected for award.

SECTION 3

PURPOSE AND SCOPE OF WORK

3.1 Purpose

MSA is issuing this RFP to contract with a qualified Testing and Inspection Firm to provide testing and inspection services related to the Arthur Perdue Stadium Improvements Project in Salisbury, MD.

Offeror will contract directly with the MSA but will be required to work in close coordination with the Design-Build team.

3.2 Scope of Services

As part of the requirements outlined in the 70% Construction Documents (**Attachment J**), the scope of testing, inspection, and lab services may include, but is not limited to, the following:

1. **Earthwork/soils**: Soil density and compaction, soil bearing capacity, suitability of soils, asphalt compaction, etc.;
2. **Environmental Conditions**: Erosion and sediment control compliance with MDE requirements;
3. **Concrete**: Compressive strength, slump, forming, reinforcing, moisture testing, floor flatness, etc.;
4. **Masonry**: Mortar, grout strength, cast stone, etc.;
5. **Steel**: Visual inspections (connection, steel and welding materials, bolted and welded connections, painting, etc.), specialized weld testing (magnetic particle, ultrasonic, liquid penetration, radiographic shear stud bond), compliance with erection plans, bearing plates, nelson studs, decking, cold formed metal framing, etc.;
6. **Roofing**: Electronic leak detection of new roof prior to substantial completion, , and manufacturer certified third party inspections, etc.;
7. **Fireproofing/Fire Resistant Materials**: Intumescent paint, spray applied fireproofing, fire stopping, etc.;
8. **Waterproofing and Air Barriers**: Inspect surface prep, application, flashing, protection, drainage components. Preconstruction testing and inspection of mockup for air barrier;
9. **Windows and skylights**: Perform air leakage, water resistance testing, structural adhesion testing, etc.; and
10. **Painting**: Pre-installation testing of interior and exterior paint material.

Further, the scope shall include the following performance requirements:

3.3 Performance Requirements

Further, the scope shall include the following performance requirements:

1. Consultant shall provide qualified personnel to construction site, as required, upon 24-hour notice.
2. Consultant shall attend necessary onsite pre-installation and construction meetings as required by MSA or DB.
3. Consultant shall coordinate sequence of inspections with MSA and DB as to not delay the construction schedule. Inspections shall be coordinated and performed so the necessity of removing and replacing construction to accommodate testing & inspections is avoided entirely.
4. Consultant shall perform specified inspections, sampling, and testing of materials as required by the specifications for this Project.
5. Consultant shall prepare lists of uncompleted work, non-conformance reports, and deficiencies notices. Reports shall be submitted to MSA and DB simultaneously within (1) day of site visit and/or completion of lab testing.
6. Consultant shall supply all field personnel with a direct means of communication and reporting protocols with their office and with the DB or MSA.
7. Consultant shall be responsible for providing, storing, and protecting their own tools, materials, and equipment. This includes the provisions for concrete cylinder cure boxes.
8. Consultant shall comply with the DB's safety plan.

3.4 Schedule – CPM

A preliminary Project Schedule outlining the current project timeline is attached (**Attachment K**).

SECTION 4

PROPOSAL SUBMISSION AND REQUIREMENTS

4.1 Solicitation Process

The solicitation will follow a multi-step process to select the successful Offeror.

4.1.1 Step 1 – Submission of Proposals

Offerors will submit a Technical and a Financial Proposal in accordance with the Key Information Summary Sheet, and Section 4 of this RFP to demonstrate experience (including meeting the minimum requirements and ability to execute the Project successfully). After the Proposal Closing Date and Time for Proposals, Technical Proposals will be reviewed and those deemed responsible and reasonably susceptible of being selected for award will be reviewed by the Selection Committee.

Offerors that fail to respond to all requirements of the RFP may be deemed not reasonably susceptible of being selected for award.

4.1.2 Step 2 – Review of Technical Proposals

The Selection Committee will review Technical Proposals and rank the Proposals according to technical merit. Based on their achieved technical rankings, selected Offerors will be "short-listed" to participate in the financial phase of the procurement.

4.1.3 Step 3 – Short-list and Financial Proposals

Based on achieved technical rankings, the Selection Committee will short-list firms to participate in the Financial Proposal phase of the procurement.

The Procurement Officer will request short-listed firms to provide the password to their Financial Proposal. Failure from the Offeror to provide the password within one (1) business day upon request by the Procurement Officer will deem the Offeror's Proposal not reasonably susceptible of being selected for award.

Offerors that are not short-listed will be notified that they are not reasonably susceptible of being selected for award.

4.1.4 Step 4 – Review of Financial Proposals

The Selection Committee will review Financial Proposals and rank the Proposals based on the overall proposed fee.

4.1.5 Step 5 – Recommendation for Award

The Offeror deemed by the Selection Committee to provide the most advantageous offer (technical and financial) to the Project will be recommended for award.

4.2 Instruction for Submission of Proposals–General Requirements

Offerors shall upload the Technical and Financial Proposals to the submission links no later than the Proposal Closing Date and Time indicated in the Key Information Summary Sheet, as revised by any addendum.

All pages of each proposal volume must be consecutively numbered from beginning (Page 1) to end (Page "x"). The final page shall state "Final Page."

Proposals compiled as machine-readable PDF-files shall be formatted so each and every page can be legibly printed in 8 ½" x 11" format.

Note: Proposals shall be protected against involuntary editing. Proposals that contain editable entries, to include but not limited to marginal comments, and unprotected fillable fields or cells, may be rejected.

4.3 Volume I – Technical Proposal

Offerors shall submit Technical Proposals labeled "OfferorShortName - TI - AWP-SI – Vol1". The Technical Proposal shall follow the format provided below.

4.3.1 Transmittal Letter

A transmittal letter must accompany the Technical Proposal. The purpose of this letter is to transmit the proposal to the Procurement Officer. The transmittal letter should be brief, and signed by an individual who is authorized to commit the Offeror to the services and requirements as stated in this RFP.

4.3.2 Title Page and Table of Contents

The Technical Proposal shall begin with a title page bearing the, Offeror's address, point of contact information (including phone number and e-mail address) for two (2) people, and the title of this RFP. A table of contents for the Proposal should follow the title page.

Information that is claimed to be confidential shall be clearly identified. Unless there is a compelling case, an entire proposal should not be labeled confidential; only those portions that can reasonably be shown to be proprietary or confidential should be so labeled.

4.3.3 Executive Summary

The Offeror shall condense and highlight the contents of the Technical Proposal in a separate section titled "Executive Summary". The Executive Summary shall:

1. Include a section providing the Offeror's credentials, to include:
   a. Offeror's legal name, and if applicable the d/b/a;
   b. Offeror's tax identification number;
   c. Two Points of Contact concerning this RFP and Offeror's Proposal;

d. Identify any joint ventures at the time of submission, if any, and the roles these relationships will have in the performance of the Contract. Upon MSA's request, Offerors shall make available within 24 hours the joint venture scope of work documents and/or agreement;

2. Include a section detailing any exceptions the Offeror has taken to the requirements of this RFP, the sample Agreement, or any other exhibits or attachments. If an Offeror takes no exception, the Executive Summary shall so state. See Section 1.40 for additional instructions.

Warning: Exceptions to terms and conditions may result in having the proposal deemed unacceptable or classified as not reasonably susceptible of being selected for award.

3. Cross-reference each qualification requirement, identified in Section 2 of the RFP, with the location in the submission (section and page number) where the Offeror has demonstrated or documented that it meets the requirement; and

4. Acknowledge the receipt of any addenda associated with this RFP.

4.3.4 Experience and Qualifications (Tab 1)

The Offeror shall provide an overview of the Offeror's experience in providing testing & inspection services, including the number of years. Offerors must include the Experience Form (**Attachment I**). See Section 2 of this RFP.

1. Information regarding the Offeror's experience and capabilities, including an overview of the Offeror's experience providing testing and inspection services.

2. The Offeror's proposal shall clearly and accurately demonstrate the specialized knowledge and experience required for consideration for materials testing and inspection services.

3. The Offeror shall demonstrate the ability to provide testing and inspection services in accordance with the applicable codes and practices, including, without limitation, the 2018 International Building Code, Wicomico County Code, and as specified in the applicable Project construction documents.

4. Three (3) references of current or previous projects (within the last three years) of relevance to the proposed scope of work must be included on the Corporate Profile (**Attachment E**).

Note: During proposal evaluation, MSA reserves the right to require that the Offeror provide a copy of its most current Annual Report or audited Statement of Financial Condition to include a Balance Sheet, Income Statement and Cash Flow Statement or other acceptable financial information. These documents may be relied upon in any determination regarding the Offeror's financial responsibility.

4.3.5 Work Plan (Tab 2)

At a minimum, Offerors shall address the following:

1. Approach: Provide a descriptive and Project specific narrative of the Offeror's approach to the items outlined in Section 3 of this RFP. Provide this information in the exact order listed and using the headings indicated. This information shall clearly demonstrate what is being proposed for this Project.
2. Staffing Plan: Provide a Staffing Plan in the format included in **Attachment F** that shows the minimum percentage of time that each Key Personnel member will dedicate to the Project.
3. Offerors shall identify any known subcontractors and/or joint ventures at the time of submission, if any, and the roles these relationships will have in the performance of the Contract. Upon MSA's request, Offerors shall make available within 24 hours all Subcontractor/Joint venture scope of work documents and proposals.

4.3.6 Other Required Submissions (Tab 3)

Offerors must submit the following items in the Technical Proposal:

1. A completed Bid/Proposal Affidavit (**Attachment A**). The form must be completed by the Offeror and all joint venture partners (if applicable).
2. A completed Conflict of Interest Information/Affidavit and Disclosure (**Attachment B**). The form must be completed by the Offeror and all joint venture partners (if applicable). By submitting a Conflict of Interest Affidavit and Disclosure, the Contractor shall be construed as certifying all Contractor Personnel and subcontractors are also without a conflict of interest as defined in COMAR 21.05.08.08A.
3. A completed MBE Form D-1A (included in **Attachment D**).
4. Corporate Profile (**Attachment E**)
5. Capacity Summary Sheet (**Attachment G**)
6. Proof of insurance certifying the Offeror's ability to comply with the insurance requirements, as set forth in the sample Contract attached hereto in **Attachment L**. The Offeror shall demonstrate its ability to meet this requirement by providing:
   a. A copy of its current certificate of insurance showing the types and limits of insurance in effect as of the Proposal submission date; or
   b. A statement from the Offeror's insurance carrier, on the carrier's letterhead, indicating the Offeror's ability to comply with the requirements set for the in **Attachment L**.
7. A completed Prime Contractor's List of All Subcontractors (**Attachment N**).

4.4 Volume II – Financial Proposal

Offerors shall submit password protected Financial Proposals labeled "OfferorShortName - TI - AWP-SI - Vol2".

Financial Proposals shall require a password to be opened, and shall be protected against involuntary editing.

After review of the Technical Proposals, the Procurement Officer will request the password to open the Financial Proposal from short-listed Offerors only. Failure from the Offeror to provide the password within one (1) business day upon request by the Procurement Officer will deem the Offeror's Proposal not reasonably susceptible of being selected for award.

A sample copy of the Pricing Form is attached as **Attachment H**. Do not amend, alter, or leave blank any items on the Pricing Form or include additional clarifying or contingent language on or attached to the Pricing Form. Failure to adhere to any of these instructions may result in the Proposal being determined to be not reasonably susceptible of being selected for award.

Note: MSA reserves the right to require, during proposal evaluation, that the Offeror provide a copy of its most current Annual Report or audited Statement of Financial Condition to include a Balance Sheet, Income Statement and Cash Flow Statement or other acceptable financial information. These documents may be relied upon in any selection determination.

SECTION 5

EVALUATION CRITERIA AND SELECTION PROCEDURE

5.1 Evaluation Criteria

Evaluation of the Proposals will be performed by the Selection Committee and will be based on the criteria set forth below. Technical Evaluation Criteria shall be given more weight than Financial Evaluation Criteria.

5.1.1 Technical Evaluation Criteria

Criteria used to rate the Technical Proposal include, without limitation, the following:

1. Understanding of the Project and adequacy of the Work Plan to provide the proposed services;
2. Experience and qualifications of the Offeror and its Key Personnel, with specific emphasis on key personnel with similar projects;
3. Past Performance and References of Offeror;
4. Work Capacity of Offeror, proposed subcontractors, and Key Personnel; and
5. Overall Quality of Submission.

5.1.2 Financial Evaluation Criteria

Short-listed Offerors that are invited to submit a password to open their Financial Proposal and that are deemed as meeting all of the requirements will be ranked (most advantageous to least advantageous) based on an analysis of the information provided in the Financial Proposal submission.

5.2 Reciprocal Preference

Although Maryland law does not authorize procuring agencies to favor resident Offerors in awarding procurement contracts, many other states do grant their resident businesses preferences over Maryland contractors. COMAR 21.05.01.04 permits procuring agencies to apply a reciprocal preference under the following conditions:

1. The Maryland resident business is a responsible Offeror;
2. The most advantageous Proposal is from a responsible Offeror whose principal office, or principal base of operations is in another state;
3. The other state gives a preference to its resident businesses through law, policy, or practice; and
4. The preference does not conflict with a federal law or grant affecting the procurement Contract.

5.3 General Selection Process

1. The Contract will be awarded in accordance with the competitive sealed proposals process under Section 3(C) of MSA's Procurement Policies.
2. Prior to award of a Contract pursuant to this RFP, MSA may require any and all Offerors to submit such additional information bearing upon the Offeror's ability to perform the contract as MSA may deem appropriate. MSA may also consider any information otherwise available concerning the financial, technical, and other qualifications or abilities of the Offeror.
3. MSA may hold discussions with any or all Offerors judged reasonably susceptible of being selected for award, or potentially so. MSA also reserves the right to develop a short-list of Offerors deemed most qualified based upon their technical Proposals and conduct discussions with only the short-listed Offerors. However, MSA also reserves the right to make an award without holding discussions. Whether or not discussions are held, MSA may determine an Offeror to be not responsible or not reasonably susceptible of being selected for award, in its sole and absolute discretion, at any time after the initial closing date for receipt of proposals and the review of those proposals.

5.4 Award Determination

Upon completion of all evaluations, discussions and negotiations, and reference checks, the Procurement Officer will recommend award of the Contract to the responsible Offeror(s) whose proposal is determined to be the most advantageous considering the technical and financial evaluation factors as set forth in this RFP. The award is subject to approval by the MSA Board of Directors.

ATTACHMENTS

Attachments can be accessed via the following link:

https://mdstad.sharefile.com/d-s98106a8f9da14c72a17efab268ec7b5b

Attachment A ..... **Bid/Proposal Affidavit**

Attachment B ..... **Conflict of Interest Affidavit and Disclosure**

Attachment C ..... **Contract Affidavit**

Attachment D ..... **MBE Instructions and Forms**

Attachment E ..... **Corporate Profile**

Attachment F ..... **Staffing Plan**

Attachment G ..... **Capacity Summary Sheet**

Attachment H ..... **Pricing Form**

Attachment I ..... **Project Experience Form**

Attachment J ..... **70% Construction Documents**

Attachment K ..... **Project Schedule**

Attachment L ..... **Sample Contract**

Attachment M ..... **MBE Search Factors**

Attachment N ..... **Prime Contractor's List of ALL Subcontractors**

ATTACHMENT A

BID/PROPOSAL AFFIDAVIT

Attachment A. Bid/Proposal Affidavit

A. AUTHORITY

I hereby affirm that I, _____ (name of affiant) am the _____ (title) and duly authorized representative of _____ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

B. CERTIFICATION REGARDING COMMERCIAL NONDISCRIMINATION

The undersigned Bidder/Offeror hereby certifies and agrees that the following information is correct: In preparing its Bid/Proposal on this project, the Bidder/Offeror has considered all Bid/Proposals submitted from qualified, potential subcontractors and suppliers, and has not engaged in "discrimination" as defined in § 19-103 of the State Finance and Procurement Article of the Annotated Code of Maryland. "Discrimination" means any disadvantage, difference, distinction, or preference in the solicitation, selection, hiring, or commercial treatment of a vendor, subcontractor, or commercial customer on the basis of race, color, religion, ancestry, or national origin, sex, age, marital status, sexual orientation, sexual identity, genetic information or an individual's refusal to submit to a genetic test or make available the results of a genetic test, disability, or any otherwise unlawful use of characteristics regarding the vendor's, supplier's, or commercial customer's employees or owners. "Discrimination" also includes retaliating against any person or other entity for reporting any incident of "discrimination". Without limiting any other provision of the solicitation on this project, it is understood that, if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal. As part of its Bid/Proposal, the Bidder/Offeror herewith submits a list of all instances within the past four (4) years where there has been a final adjudicated determination in a legal or administrative proceeding in the State of Maryland that the Bidder/Offeror discriminated against subcontractors, vendors, suppliers, or commercial customers, and a description of the status or resolution of that determination, including any remedial action taken. Bidder/Offeror agrees to comply in all respects with the State's Commercial Nondiscrimination Policy as described under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland.

B-1. CERTIFICATION REGARDING MINORITY BUSINESS ENTERPRISES.

The undersigned Bidder/Offeror hereby certifies and agrees that it has fully complied with the State Minority Business Enterprise Law, State Finance and Procurement Article, § 14-308(a)(2), Annotated Code of Maryland, which provides that, except as otherwise provided by law, a contractor may not identify a certified minority business enterprise in a Bid/Proposal and:

(1) Fail to request, receive, or otherwise obtain authorization from the certified minority business enterprise to identify the certified minority bid/proposal;

(2) Fail to notify the certified minority business enterprise before execution of the contract of its inclusion in the Bid/Proposal;

(3) Fail to use the certified minority business enterprise in the performance of the contract; or

(4) Pay the certified minority business enterprise solely for the use of its name in the

Bid/Proposal.

Without limiting any other provision of the solicitation on this project, it is understood that if the certification is false, such false certification constitutes grounds for the State to reject the Bid/Proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the Bid/Proposal.

B-2. CERTIFICATION REGARDING VETERAN-OWNED SMALL BUSINESS ENTERPRISES.

The undersigned Bidder/Offeror hereby certifies and agrees that it has fully complied with the State veteran-owned small business enterprise law, State Finance and Procurement Article, § 14-605, Annotated Code of Maryland, which provides that a person may not:

(1) Knowingly and with intent to defraud, fraudulently obtain, attempt to obtain, or aid another person in fraudulently obtaining or attempting to obtain public money, procurement contracts, or funds expended under a procurement contract to which the person is not entitled under this title;

(2) Knowingly and with intent to defraud, fraudulently represent participation of a veteran-owned small business enterprise in order to obtain or retain a Bid/Proposal preference or a procurement contract;

(3) Willfully and knowingly make or subscribe to any statement, declaration, or other document that is fraudulent or false as to any material matter, whether or not that falsity or fraud is committed with the knowledge or consent of the person authorized or required to present the declaration, statement, or document;

(4) Willfully and knowingly aid, assist in, procure, counsel, or advise the preparation or presentation of a declaration, statement, or other document that is fraudulent or false as to any material matter, regardless of whether that falsity or fraud is committed with the knowledge or consent of the person authorized or required to present the declaration, statement, or document;

(5) Willfully and knowingly fail to file any declaration or notice with the unit that is required by COMAR 21.11.13; or

(6) Establish, knowingly aid in the establishment of, or exercise control over a business found to have violated a provision of § B-2(1) -(5) of this regulation.

C. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business (as is defined in Section 16-101(b) of the State Finance and Procurement Article of the Annotated Code of Maryland), or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or performing contracts with public bodies has been convicted of, or has had probation before judgment imposed pursuant to Criminal Procedure Article, § 6-220, Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows (indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the business):

D. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities including obtaining or performing contracts with public bodies, has:

(1) Been convicted under state or federal statute of:

(a) A criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract; or

(b) Fraud, embezzlement, theft, forgery, falsification or destruction of records or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. § 1961 et seq., or the Mail Fraud Act, 18 U.S.C. § 1341 et seq., for acts in connection with the submission of Bids/Proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, § 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of a violation of § 11-205.1 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(6) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsections (1)— (5) above;

(7) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of Bids/Proposals for a public or private contract;

(8) Been found in a final adjudicated decision to have violated the Commercial Nondiscrimination Policy under Title 19 of the State Finance and Procurement Article of the Annotated Code of Maryland with regard to a public or private contract;

(9) Been convicted of a violation of one or more of the following provisions of the Internal Revenue Code:

(a) §7201, Attempt to Evade or Defeat Tax;

(b) §7203, Willful Failure to File Return, Supply Information, or Pay Tax,

(c) §7205, Fraudulent Withholding Exemption Certificate or Failure to Supply Information;

(d) §7206, Fraud and False Statements, or

(e) §7207 Fraudulent Returns, Statements, or Other Documents;

(10) Been convicted of a violation of 18 U.S.C. §286 Conspiracy to Defraud the Government with Respect to Claims, 18 U.S.C. §287, False, Fictitious, or Fraudulent Claims, or 18 U.S.C. §371, Conspiracy to Defraud the United States;

(11) Been convicted of a violation of the Tax-General Article, Title 13, Subtitle 7 or Subtitle 10, Annotated Code of Maryland;

(12) Been found to have willfully or knowingly violated State Prevailing Wage Laws as provided in the State Finance and Procurement Article, Title 17, Subtitle 2, Annotated Code of Maryland, if:

(a) A court:

(i) Made the finding; and

(ii) Decision became final; or

(b) The finding was:

(i) Made in a contested case under the Maryland Administrative Procedure act; and

(ii) Not overturned on judicial review;

(13) Been found to have willfully or knowingly violated State Living Wage Laws as provided in the State Finance and Procurement Article, Title 18, Annotated Code of Maryland, if:

(a) A court:

(i) Made the finding; and

(ii) Decision became final; or

(b) The finding was:

(i) Made in a contested case under the Maryland Administrative Procedure act; and

(ii) Not overturned on judicial review;

(14) Been found to have willfully or knowingly violated the Labor and Employment Article, Title 3, Subtitles 3, 4, or 5, or Title 5, Annotated Code of Maryland, if:

(a) A court:

(i) Made the finding; and

(ii) Decision became final; or

(b) The finding was:

(i) Made in a contested case under the Maryland Administrative Procedure act; and

(ii) Not overturned on judicial review; or

(15) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described in §§ B and C and subsections D(1)—(14) above, except as follows (indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the business, and the status of any debarment):

E. AFFIRMATION REGARDING DEBARMENT

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, or any of its officers, directors, partners, controlling stockholders, or any of its employees directly involved in the business's contracting activities, including obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows (list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceedings, the

name(s) of the person(s) involved and their current positions and responsibilities with the business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension).

F. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The business was not established and does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows (you must indicate the reasons why the affirmations cannot be given without qualification):

G. SUBCONTRACT AFFIRMATION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

H. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the above business has:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying Bid/Proposal that is being submitted; or

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the Bid/Proposal price of the Bidder/Offeror or of any competitor, or otherwise taken any action in restraint of free competitive bidding in connection with the contract for which the accompanying Bid/Proposal is submitted.

I. CERTIFICATION OF TAX PAYMENT

I FURTHER AFFIRM THAT:

Except as validly contested, the business has paid, or has arranged for payment of, all taxes due the State of Maryland and has filed all required returns and reports with the Comptroller of the Treasury, State Department of Assessments and Taxation, and Department of Labor, Licensing, and Regulation, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

J. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency working for the business, to solicit or secure the Contract, and that the business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee, bona fide agent, bona fide salesperson, or commercial selling agency, any fee or any other consideration contingent on the making of the Contract.

K. CERTIFICATION REGARDING INVESTMENTS IN IRAN

(1) The undersigned certifies that, in accordance with State Finance and Procurement Article, §17-705, Annotated Code of Maryland:

(a) It is not identified on the list created by the Board of Public Works as a person engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland; and

(b) It is not engaging in investment activities in Iran as described in State Finance and Procurement Article, §17-702, Annotated Code of Maryland.

(2) The undersigned is unable to make the above certification regarding its investment activities in Iran due to the following activities:

L. CONFLICT MINERALS ORIGINATED IN THE DEMOCRATIC REPUBLIC OF CONGO (FOR SUPPLIES AND SERVICES CONTRACTS)

I FURTHER AFFIRM THAT:

The business has complied with the provisions of State Finance and Procurement Article, §14-413, Annotated Code of Maryland governing proper disclosure of certain information regarding conflict minerals originating in the Democratic Republic of Congo or its neighboring countries as required by federal law.

M. PROHIBITING DISCRIMINATORY BOYCOTTS OF ISRAEL

I FURTHER AFFIRM THAT:

In preparing its bid/proposal on this project, the Bidder/Offeror has considered all bid/proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of any subcontractor, vendor, or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity on the basis of Israeli national origin, or residence or incorporation in Israel and its territories. The Bidder/Offeror also has not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. Without limiting any other provision of the solicitation for bid/proposals for this project, it is understood and agreed that, if this certification is false, such false certification will constitute grounds for the State to reject the bid/proposal submitted by the Bidder/Offeror on this project, and terminate any contract awarded based on the bid/proposal.

N. I FURTHER AFFIRM THAT:

Any claims of environmental attributes made relating to a product or service included in the bid or bid/proposal are consistent with the Federal Trade Commission's Guides for the Use of Environmental Marketing Claims as provided in 16 C.F.R. §260, that apply to claims about the environmental attributes of a product, package or service in connection with the marketing, offering for sale, or sale of such item or service.

O. ACKNOWLEDGEMENT

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the Procurement Officer and may be distributed to units of: (1) the State of Maryland; (2) counties or other subdivisions of the State of Maryland; (3) other states; and (4) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this Bid/proposal shall be construed to supersede, amend, modify or waive, on behalf of the State of Maryland, or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the above business with respect to (1) this Affidavit, (2) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

By: _____
Signature of Authorized Representative and Affiant

Printed Name: _____
Printed Name of Authorized Representative and Affiant

Title: _____
Title

Date: _____
Date

ATTACHMENT B

CONFLICT OF INTEREST AFFIDAVIT AND DISCLOSURE

Attachment I. Conflict of Interest Affidavit and Disclosure

Reference COMAR 21.05.08.08

A. "Conflict of interest" means that because of other activities or relationships with other persons, a person is unable or potentially unable to render impartial assistance or advice to the State, or the person's objectivity in performing the contract work is or might be otherwise impaired, or a person has an unfair competitive advantage.

B. "Person" has the meaning stated in COMAR 21.01.02.01B(64) and includes a Offeror, Contractor, consultant, or subcontractor or sub-consultant at any tier, and also includes an employee or agent of any of them if the employee or agent has or will have the authority to control or supervise all or a portion of the work for which a Proposal is made.

C. The Offeror warrants that, except as disclosed in §D, below, there are no relevant facts or circumstances now giving rise or which could, in the future, give rise to a conflict of interest.

D. The following facts or circumstances give rise or could in the future give rise to a conflict of interest (explain in detail — attach additional sheets if necessary):

E. The Offeror agrees that if an actual or potential conflict of interest arises after the date of this affidavit, the Offeror shall immediately make a full disclosure in writing to the procurement officer of all relevant facts and circumstances. This disclosure shall include a description of actions which the Offeror has taken and proposes to take to avoid, mitigate, or neutralize the actual or potential conflict of interest. If the contract has been awarded and performance of the contract has begun, the Contractor shall continue performance until notified by the procurement officer of any contrary action to be taken.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: _____ By: _____

(Authorized Representative and Affiant)

SUBMIT THIS AFFIDAVIT WITH BID/PROPOSAL

ATTACHMENT C

CONTRACT AFFIDAVIT

Attachment C. Contract Affidavit

A. AUTHORITY

I hereby affirm that I, _____ (name of affiant) am the _____ (title) and duly authorized representative of _____ (name of business entity) and that I possess the legal authority to make this affidavit on behalf of the business for which I am acting.

B. CERTIFICATION OF REGISTRATION OR QUALIFICATION WITH THE STATE DEPARTMENT OF ASSESSMENTS AND TAXATION

I FURTHER AFFIRM THAT:

The business named above is a (check applicable box):

(1) Corporation - ☐ domestic or ☐ foreign;

(2) Limited Liability Company - ☐ domestic or ☐ foreign;

(3) Partnership - ☐ domestic or ☐ foreign;

(4) Statutory Trust - ☐ domestic or ☐ foreign;

(5) ☐ Sole Proprietorship.

and is registered or qualified as required under Maryland Law. I further affirm that the above business is in good standing both in Maryland and (IF APPLICABLE) in the jurisdiction where it is presently organized, and has filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation. The name and address of its resident agent (IF APPLICABLE) filed with the State Department of Assessments and Taxation is:

Name and Department ID Number: _____

Address: _____

and that if it does business under a trade name, it has filed a certificate with the State Department of Assessments and Taxation that correctly identifies that true name and address of the principal or owner as:

Name and Department ID Number: _____

Address: _____

C. FINANCIAL DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, the provisions of State Finance and Procurement Article, §13-221, Annotated Code of Maryland, which require that every business that enters into contracts, leases, or other agreements with the State of Maryland or its agencies during a calendar year under which the business is to receive in the aggregate $200,000 or more shall, within 30 days of the time when the aggregate value of the contracts, leases, or other agreements reaches $200,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

D. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

I am aware of, and the above business will comply with, Election Law Article, Title 14, Annotated Code of Maryland, which requires that every person that enters into a procurement contract with the State, a county, or a municipal corporation, or other political subdivision of the State, during a calendar year in which the person receives a contract with a governmental entity in the amount of

$200,000 or more, shall file with the State Board of Elections statements disclosing: (a) any contributions made during the reporting period to a candidate for elective office in any primary or general election; and (b) the name of each candidate to whom one or more contributions in a cumulative amount of $500 or more were made during the reporting period. The statement shall be filed with the State Board of Elections: (a) before execution of a contract by the State, a county, a municipal corporation, or other political subdivision of the State, and shall cover the 24 months prior to when a contract was awarded; and (b) if the contribution is made after the execution of a contract, then twice a year, throughout the contract term, on or before: (i) May 31, to cover the six (6) month period ending April 30; and (ii) November 30, to cover the six (6) month period ending October 31.

E. DRUG AND ALCOHOL FREE WORKPLACE

(Applicable to all contracts unless the contract is for a law enforcement agency and the agency head or the agency head's designee has determined that application of COMAR 21.11.08 and this certification would be inappropriate in connection with the law enforcement agency's undercover operations.)

I CERTIFY THAT:

(1) Terms defined in COMAR 21.11.08 shall have the same meanings when used in this certification.

(2) By submission of its Proposal, the business, if other than an individual, certifies and agrees that, with respect to its employees to be employed under a contract resulting from this solicitation, the business shall:

(a) Maintain a workplace free of drug and alcohol abuse during the term of the contract;

(b) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of drugs, and the abuse of drugs or alcohol is prohibited in the business' workplace and specifying the actions that will be taken against employees for violation of these prohibitions;

(c) Prohibit its employees from working under the influence of drugs or alcohol;

(d) Not hire or assign to work on the contract anyone who the business knows, or in the exercise of due diligence should know, currently abuses drugs or alcohol and is not actively engaged in a bona fide drug or alcohol abuse assistance or rehabilitation program;

(e) Promptly inform the appropriate law enforcement agency of every drug-related crime that occurs in its workplace if the business has observed the violation or otherwise has reliable information that a violation has occurred;

(f) Establish drug and alcohol abuse awareness programs to inform its employees about:

(i) The dangers of drug and alcohol abuse in the workplace;

(ii) The business's policy of maintaining a drug and alcohol free workplace;

(iii) Any available drug and alcohol counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees who abuse drugs and alcohol in the workplace;

(g) Provide all employees engaged in the performance of the contract with a copy of the statement required by §E(2)(b), above;

(h) Notify its employees in the statement required by §E(2)(b), above, that as a condition of continued employment on the contract, the employee shall:

(i) Abide by the terms of the statement; and

(ii) Notify the employer of any criminal drug or alcohol abuse conviction for an offense occurring in the workplace not later than 5 days after a conviction;

(i) Notify the procurement officer within 10 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction;

(j) Within 30 days after receiving notice under §E(2)(h)(ii), above, or otherwise receiving actual notice of a conviction, impose either of the following sanctions or remedial measures on any employee who is convicted of a drug or alcohol abuse offense occurring in the workplace:

(i) Take appropriate personnel action against an employee, up to and including termination; or

(ii) Require an employee to satisfactorily participate in a bona fide drug or alcohol abuse assistance or rehabilitation program; and

(k) Make a good faith effort to maintain a drug and alcohol free workplace through implementation of §E(2)(a)—(j), above.

(3) If the business is an individual, the individual shall certify and agree as set forth in §E(4), below, that the individual shall not engage in the unlawful manufacture, distribution, dispensing, possession, or use of drugs or the abuse of drugs or alcohol in the performance of the contract.

(4) I acknowledge and agree that:

(a) The award of the contract is conditional upon compliance with COMAR 21.11.08 and this certification;

(b) The violation of the provisions of COMAR 21.11.08 or this certification shall be cause to suspend payments under, or terminate the contract for default under COMAR 21.07.01.11 or 21.07.03.15, as applicable; and

(c) The violation of the provisions of COMAR 21.11.08 or this certification in connection with the contract may, in the exercise of the discretion of the Board of Public Works, result in suspension and debarment of the business under COMAR 21.08.03.

F. CERTAIN AFFIRMATIONS VALID

I FURTHER AFFIRM THAT:

To the best of my knowledge, information, and belief, each of the affirmations, certifications, or acknowledgements contained in that certain Bid/Proposal Affidavit dated _____, and executed by me for the purpose of obtaining the contract to which this Exhibit is attached remains true and correct in all respects as if made as of the date of this Contract Affidavit and as if fully set forth herein.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: _____

By: _____ (print name of Authorized Representative and Affiant)

_____ (signature of Authorized Representative and Affiant)

ATTACHMENT D
MBE INSTRUCTIONS AND FORMS

Attachment D. Minority Business Enterprise (MBE) Forms

D-1A
MBE UTILIZATION AND FAIR SOLICITATION AFFIDAVIT
& MBE PARTICIPATION SCHEDULE

PART 1 - INSTRUCTIONS

PLEASE READ BEFORE COMPLETING THIS DOCUMENT

This form includes Instructions and the MBE Utilization and Fair Solicitation Affidavit & MBE Participation Schedule which must be submitted with the bid/proposal. If the bidder/offeror fails to accurately complete and submit this Affidavit and Schedule with the bid or proposal, the Procurement Officer shall deem the bid non-responsive or shall determine that the proposal is not reasonably susceptible of being selected for award unless the inaccuracy is determined to be the result of a minor irregularity that is waived or cured in accordance with COMAR 21.06.02.04.

1. Contractor shall structure its procedures for the performance of the work required in this Contract to attempt to achieve the minority business enterprise (MBE) subcontractor participation goal stated in the Invitation for Bids or Request for Proposals. Contractor agrees to exercise good faith efforts to carry out the requirements set forth in these Instructions, as authorized by the Code of Maryland Regulations (COMAR) 21.11.03.

2. MBE Goals and Subgoals: Please review the solicitation for information regarding the Contract's MBE overall participation goals and subgoals. After satisfying the requirements for any established subgoals, the Contractor is encouraged to use a diverse group of subcontractors and suppliers from the various MBE classifications to meet the remainder of the overall MBE participation goal.

3. MBE means a minority business enterprise that is certified by the Maryland Department of Transportation ("MDOT"). Only MBEs certified by MDOT may be counted for purposes of achieving the MBE participation goals. In order to be counted for purposes of achieving the MBE participation goals, the MBE firm, including a MBE prime, must be MDOT-certified for the services, materials or supplies that it is committed to perform on the MBE Participation Schedule. A firm whose MBE certification application is pending may not be counted.

4. Please refer to the MDOT MBE Directory at https://mbe.mdot.maryland.gov/directory/ to determine if a firm is certified with the appropriate North American Industry Classification System ("NAICS") Code **and** the product/services description (specific product that a firm is certified to provide or specific areas of work that a firm is certified to perform). For more general information about NAICS codes, please visit https://www.census.gov/eos/www/naics/. Only those specific products and/or services for which a firm is certified in the MDOT Directory can be used for purposes of achieving the MBE participation goals. **CAUTION:** If the firm's NAICS Code is in graduated status, such services/products may not be counted for purposes of achieving the MBE participation goals. A NAICS Code is in the graduated status if the term "Graduated" follows the Code in the MDOT MBE Directory.

5. **Guidelines Regarding MBE Prime Self-Performance.** Please note that when a certified MBE firm participates as a prime contractor on a Contract, a procurement agency may count the distinct, clearly defined portion of the work of the Contract that the certified MBE firm performs with its own workforce toward fulfilling up to, but no more than, fifty-percent (50%) of the overall

MBE participation goal, including up to one hundred percent (100%) of not more than one of the MBE participation subgoals, if any, established for the Contract.

- ✓ In order to receive credit for self-performance, an MBE prime must be certified in the appropriate NAICS code to do the work and must list its firm in the MBE Participation Schedule, including the certification category under which the MBE prime is self-performing and include information regarding the work it will self-perform.
- ✓ For the remaining portion of the overall goal and the remaining subgoals, the MBE prime must also identify on the MBE Participation Schedule the other certified MBE subcontractors used to meet those goals or request a waiver.
- ✓ These guidelines apply to the work performed by the MBE Prime that can be counted for purposes of meeting the MBE participation goals. These requirements do not affect the MBE Prime's ability to self-perform a greater portion of the work in excess of what is counted for purposes of meeting the MBE participation goals.
- ✓ Please note that the requirements to meet the MBE participation overall goal and subgoals are distinct and separate. If the contract has subgoals, regardless of MBE Prime's ability to self-perform up to 50% of the overall goal (including up to 100% of any subgoal), the MBE Prime must either commit to use other MBEs for each of any remaining subgoals or request a waiver. As set forth in Attachment 1-B Waiver Guidance, the MBE Prime's ability to self-perform certain portions of the work of the Contract will not be deemed a substitute for the good faith efforts to meet any remaining subgoal or the balance of the overall goal.
- ✓ In certain instances where the percentages allocated to MBE participation subgoals add up to more than 50% of the overall goal, the portion of self-performed work that an MBE Prime may count toward the overall goal may be limited to less than 50%. Please refer to the Governor's Office of Small Minority & Women Business Affairs' website for the MBE Prime Regulations Q&A for illustrative examples. http://www.goMDsmallbiz.maryland.gov/Documents/MBE_Toolkit/MBEPrimeRegulation_QA.pdf

6. Subject to items 1 through 5 above, when a certified MBE performs as a participant in a joint venture, a procurement agency may count a portion of the total dollar value of the Contract equal to the distinct, clearly-defined portion of the work of the Contract that the certified MBE performs with its own forces toward fulfilling the Contract goal, and not more than one of the Contract subgoals, if any.

7. The work performed by a certified MBE firm, including an MBE prime, can only be counted towards the MBE participation goal(s) if the MBE firm is performing a commercially useful function on the Contract. Please refer to COMAR 21.11.03.12-1 for more information regarding these requirements.

8. **Materials and Supplies: New Guidelines Regarding MBE Participation.**

   - ✓ Regular Dealer (generally identified as a wholesaler or supplier in the MDOT Directory): Up to 60% of the costs of materials and supplies provided by a certified MBE may be counted towards the MBE participation goal(s) if such MBE is a Regular Dealer of such materials and supplies. Regular Dealer is defined as a firm that owns, operates, or maintains a store, a warehouse, or any other establishment in which the materials, supplies, articles, or equipment are of the general character described by the specifications required under the contract and are bought, kept in stock, or regularly sold or leased to the

public in the usual course of business; and does not include a packager, a broker, a manufacturer's representative, or any other person that arranges or expedites transactions.

Example for illustrative purposes of applying the 60% rule:

Overall contract value: $2,000,000
Total value of supplies: $100,000

Calculate Percentage of Supplies to overall contract value: $100,000 divided by $2,000,000 = 5%

Apply 60% Rule - Total percentage of Supplies/Products 5% x 60% = 3%

***3%** would be counted towards achieving the MBE Participation Goal and Subgoal, if any, for the MBE supplier in this example.*

- ✓ Manufacturer: A certified MBE firm's participation may be counted in full if the MBE is certified in the appropriate NAICS code(s) to provide products and services as a manufacturer.

- ✓ Broker: With respect to materials or supplies purchased from a certified MBE that is neither a manufacturer nor a regular dealer, a unit may apply the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, fees, or transportation charges for the delivery of materials and supplies required on a procurement toward the MBE contract goals, provided a unit determines the fees to be reasonable and not excessive as compared with fees customarily allowed for similar services. A unit may not apply any portion of the costs of the materials and supplies toward MBE goals.

- ✓ Furnish and Install and other Services: The participation of a certified MBE supplier, wholesaler, and/or regular dealer certified in the proper NAICS code(s) to furnish and install materials necessary for successful contract completion may be counted in full. Includes the participation of other MBE service providers in the proper NAICS code(s) may be counted in full.

9. **Dually certified firms**. An MBE that is certified in more than one subgroup category may only be counted toward goal fulfillment of ONE of those categories with regard to a particular contract.

   Example: A woman-owned Hispanic American (dually certified) firm may be used to fulfill the women-owned OR Hispanic American subgoal, but not both on the same contract.

10. CAUTION: The percentage of MBE participation, computed using the percentage amounts determined for all of the MBE firms listed in PART 3, MUST meet or exceed the MBE participation goal and subgoals (if applicable) as set forth in PART 2- for this solicitation. If a bidder/offeror is unable to meet the MBE participation goal or any subgoals (if applicable), then the bidder/offeror must request a waiver in PART 2 or the bid will be deemed not responsive, or the proposal not reasonably susceptible of being selected for award. You may wish to use the attached Goal/Subgoal Worksheet to assist in calculating the percentages and confirming that your commitment meets or exceeds the applicable MBE participation goal and subgoals (if any).

11. If you have any questions as to whether a firm is certified to perform the specific services or provide specific products, please contact MDOT's Office of Minority Business Enterprise at 1-

800-544-6056 or via email to mbe@mdot.state.md.us sufficiently prior to the submission due date.

Subgoals (if applicable)

Total African American MBE Participation:	_____%
Total Asian American MBE Participation:	_____%
Total Hispanic American MBE Participation:	_____%
Total Women-Owned MBE Participation:	_____%

Overall Goal

Total MBE Participation (include all categories):	_____%

PART 2 - MBE UTILIZATION AND FAIR SOLICITATION AFFIDAVIT & MBE PARTICIPATION SCHEDULE

This MBE Utilization and Fair Solicitation Affidavit and MBE Participation Schedule must be completed in its entirety and included with the bid/proposal. If the bidder/offeror fails to accurately complete and submit this Affidavit and Schedule with the bid or proposal as required, the Procurement Officer shall deem the bid non-responsive or shall determine that the proposal is not reasonably susceptible of being selected for award.

In connection with the bid/proposal submitted in response to Solicitation

TI - Arthur Perdue Stadium Improvements, I affirm the following:

1. **MBE Participation (PLEASE CHECK ONLY ONE)**

☐ I acknowledge and intend to meet IN FULL both the overall certified Minority Business Enterprise (MBE) participation goal of ten percent (10%).

Therefore, I am not seeking a waiver pursuant to COMAR 21.11.03.11. I acknowledge that by checking the above box and agreeing to meet the stated goal and subgoal(s), if any, I **must** complete PART 3 - MBE Participation Schedule and Part 4 Signature Page in order to be considered for award.

OR

☐ After making good faith outreach efforts prior to making this submission, I conclude that I am unable to achieve the MBE participation goal and/or subgoals. I hereby request a waiver, in whole or in part, of the overall goal and/or subgoals I acknowledge that by checking this box and requesting a partial waiver of the stated goal and/or one or more of the stated subgoal(s) if any, I must complete Part 3, the MBE Participation Schedule and Part 4 Signature Page for the portion of the goal and/or subgoal(s) if any, for which I am not seeking a waiver, in order to be considered for award. I acknowledge that by checking this box and requesting a full waiver of the stated goal and the stated subgoal(s) if any, I must complete Part 4 Signature Page in order to be considered for award.

Additional MBE Documentation

I understand that if I am notified that I am the apparent awardee or as requested by the Procurement Officer, I must submit the following documentation within 10 working days of receiving notice of the potential award or from the date of conditional award (per COMAR 21.11.03.10), whichever is earlier:

(a) Good Faith Efforts Documentation to Support Waiver Request (Attachment D-1C)

(b) Outreach Efforts Compliance Statement (Attachment D-2);

(c) MBE Subcontractor/MBE Prime Project Participation Statement (Attachments D-3A and 3B);

(d) Any other documentation, including additional waiver documentation if applicable, required by the Procurement Officer to ascertain bidder or offeror responsibility in connection with the certified MBE participation goal and subgoals, if any.

I understand that if I fail to return each completed document within the required time, the Procurement Officer may determine that I am not responsible and therefore not eligible for contract award. If the contract has already been awarded, the award is voidable.

Information Provided to MBE firms

In the solicitation of subcontract quotations or offers, MBE firms were provided not less than the same information and amount of time to respond as were non-MBE firms.

PART 3 - MBE PARTICIPATION SCHEDULE

SET FORTH BELOW ARE THE (I) CERTIFIED MBEs I INTEND TO USE, (II) THE PERCENTAGE OF THE TOTAL CONTRACT VALUE ALLOCATED TO EACH MBE FOR THIS PROJECT AND, (III) THE ITEMS OF WORK EACH MBE WILL PROVIDE UNDER THE CONTRACT. I HAVE CONFIRMED WITH THE MDOT DATABASE THAT THE MBE FIRMS IDENTIFIED BELOW (INCLUDING ANY SELF-PERFORMING MBE PRIME FIRMS) ARE PERFORMING WORK ACTIVITIES FOR WHICH THEY ARE MDOT-CERTIFIED.

Prime Contractor	Project Description	Project/Contract Number
		TI - AWP-SI

LIST INFORMATION FOR EACH CERTIFIED MBE FIRM YOU AGREE TO USE TO ACHIEVE THE MBE PARTICIPATION GOAL AND SUBGOALS, IF ANY. MBE PRIMES: PLEASE COMPLETE BOTH SECTIONS A AND B BELOW.

SECTION A: For MBE Prime Contractors ONLY (including MBE Primes in a Joint Venture)

MBE Prime Firm Name:_____

MBE Certification Number: _____

(If dually certified, check only one box.)

☐ African American-Owned
☐ Hispanic American- Owned
☐ Asian American-Owned
☐ Women-Owned
☐ Other MBE Classification

NAICS code: _____

Percentage of total Contract Value to be performed with own forces and counted towards the MBE **overall participation goal** (up to 50% of the overall goal): _____% **Please refer to Item #8 in Part 1- Instructions of this document for new MBE participation guidelines regarding materials and supplies.**

Percentage of total Contract Value to be performed with own forces and counted towards the **subgoal**, if any, for my MBE classification (up to 100% of not more than one subgoal): _____%

☐ Supplier, wholesaler and/or regular dealer (count 60%)
☐ Manufacturer (count 100%)
☐ Broker (count reasonable fee/commission only)
☐ Furnish and Install and other Services (count 100%)

Complete the applicable prompt (select only one) from prompts A-C below that applies to the type of work your firm is self-performing to calculate amount to be counted towards achieving the MBE Participation Goal and Subgoal, if any.

A. Percentage amount of subcontract where the MBE Prime firm is being used for manufacturer, furnish and install, and/or services (excluding products / services from suppliers, wholesalers, regular dealers and brokers) **___%**

B. Percentage amount for items of work where the MBE Prime firm is being used as supplier, wholesaler, and/or regular dealer (60% Rule).
Total percentage of Supplies/Products **___**% x 60% = **___%**

C. Percentage amount of fee where the MBE Prime firm is being used as broker (count reasonable fee/commission only) **___ %**

Description of the work to be performed with MBE prime's own forces:
_____
_____

SECTION B: For all Contractors (including MBE Primes and MBE Primes in a Joint Venture)

MBE Firm Name:_____ MBE Certification Number: _____ (If dually certified, check only one box.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification NAICS code: _____	**Please refer to Item #8 in Part 1- Instructions of this document for new MBE participation guidelines regarding materials and supplies.** ☐ Supplier, wholesaler and/or regular dealer (count 60%) ☐ Manufacturer (count 100%) ☐ Broker (count reasonable fee/commission only) ☐ Furnish and Install and other Services (count 100%) **Complete the applicable prompt (select only one) from prompts A-C below that applies to the type of work that the MBE firm named to the left will be performing to calculate the amount to be counted towards achieving the MBE Participation Goal and Subgoal, if any.** **A. Percentage of total contract amount where the MBE firm is being used for manufacturer, furnish and install, and/or services** (excluding products/services from suppliers, wholesalers, regular dealers and brokers) **___%** **B. Percentage of total contract amount for items of work where the MBE firm is being used as supplier, wholesaler, and/or regular dealer** (60% Rule)**)**. Total percentage of Supplies/Products ___% X 60% = **___%** **C. Percentage amount of fee where the MBE firm is being used as broker** (count reasonable fee/commission only) **___ %** Description of the work to be performed: _____ _____
MBE Firm Name:_____ MBE Certification Number: _____ (If dually certified, check only one box.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification NAICS code: _____	**Please refer to Item #8 in Part 1- Instructions of this document for new MBE participation guidelines regarding materials and supplies.** ☐ Supplier, wholesaler and/or regular dealer (count 60%) ☐ Manufacturer (count 100%) ☐ Broker (count reasonable fee/commission only) ☐ Furnish and Install and other Services (count 100%) **Complete the applicable prompt (select only one) from prompts A-C below that applies to the type of work that the MBE Firm named to the left will be performing to calculate the amount to be counted towards achieving the MBE Participation Goal and Subgoal, if any.** **A. Percentage of total contract amount where the MBE firm is being used for manufacturer, furnish and install, and/or services** (excluding products/services from suppliers, wholesalers, regular dealers and brokers) **___%** **B. Percentage of total contract amount for items of work where the MBE firm is being used as supplier, wholesaler, and/or regular dealer** (60% Rule)**)**. Total percentage of Supplies/Products ___% X 60% = **___%** **C. Percentage amount of fee where the MBE firm is being used as broker** (count reasonable fee/commission only) **___ %** Description of the work to be performed: _____ _____

MBE Firm Name:_____ MBE Certification Number: _____ (If dually certified, check only one box.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification NAICS code: _____	**Please refer to Item #8 in Part 1- Instructions of this document for new MBE participation guidelines regarding materials and supplies.** ☐ Supplier, wholesaler and/or regular dealer (count 60%) ☐ Manufacturer (count 100%) ☐ Broker (count reasonable fee/commission only) ☐ Furnish and Install and other Services (count 100%) **Complete the applicable prompt (select only one) from prompts A-C below that applies to the type of work that for the MBE firm named to the left will be performing to calculate the amount to be counted towards achieving the MBE Participation Goal and Subgoal, if any.** **A. Percentage of total contract amount where the MBE firm is being used for manufacturer, furnish and install, and/or services** (excluding products/services from suppliers, wholesalers, regular dealers and brokers) **___%** **B. Percentage of the total contract amount for items of work where the MBE firm is being used as supplier, wholesaler, and/or regular dealer** (60% Rule). Total percentage of Supplies/Products ___% X 60% = **___%** **C. Percentage amount of fee where the MBE firm is being used as broker** (count reasonable fee/commission only) **___ %** Description of the work to be performed: _____ _____
MBE Firm Name:_____ MBE Certification Number: _____ (If dually certified, check only one box.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification NAICS code: _____	**Please refer to Item #8 in Part 1- Instructions of this document for new MBE participation guidelines regarding materials and supplies.** ☐ Supplier, wholesaler and/or regular dealer (count 60%) ☐ Manufacturer (count 100%) ☐ Broker (count reasonable fee/commission only) ☐ Furnish and Install and other Services (count 100%) **Complete the applicable prompt (select only one) from prompts A-C below that applies to the type of work that the MBE firm named to the left will be performing to calculate the amount to be counted towards achieving the MBE Participation Goal and Subgoal, if any.** **A. Percentage of total contract amount where the MBE firm is being used for manufacturer, furnish and install, and/or services** (excluding products/services from suppliers, wholesalers, regular dealers and brokers) **___%** **B. Percentage of total contract amount for items of work where the MBE firm is being used as supplier, wholesaler, and/or regular dealer** (60% Rule)**)**. Total percentage of Supplies/Products ___% X 60% = **___%** **C. Percentage amount of fee where the MBE firm is being used as broker___ %** Description of the work to be performed: _____ _____

CONTINUE ON SEPARATE PAGE IF NEEDED

PART 4 – SIGNATURE PAGE

To complete Affidavit committing to MBE(s) or requesting waiver, Bidder/Offeror must sign below:

I solemnly affirm under the penalties of perjury that: (i) I have reviewed the instructions for the MBE Utilization & Fair Solicitation Affidavit and MBE Schedule, and (ii) the information contained in the MBE Utilization & Fair Solicitation Affidavit and MBE Schedule is true to the best of my knowledge, information and belief.

_____	_____
Bidder/Offeror Name *(PLEASE PRINT OR TYPE)*	Signature of Authorized Representative
_____	_____
Address	Printed Name and Title
_____	_____
City, State and Zip Code	Date

SUBMIT THIS AFFIDAVIT WITH BID/PROPOSAL

D-1B WAIVER GUIDANCE

GUIDANCE FOR DOCUMENTING GOOD FAITH EFFORTS TO MEET MBE PARTICIPATION GOALS

In order to show that it has made good faith efforts to meet the Minority Business Enterprise (MBE) participation goal (including any MBE subgoals) on a contract, the Offeror must either (1) meet the MBE Goal(s) and document its commitments for participation of MBE Firms, or (2) when it does not meet the MBE Goal(s), document its Good Faith Efforts to meet the goal(s).

I. Definitions

MBE Goal(s) – "MBE Goal(s)" refers to the MBE participation goal and MBE participation subgoal(s).

Good Faith Efforts - The "Good Faith Efforts" requirement means that when requesting a waiver, the Offeror must demonstrate that it took all necessary and reasonable steps to achieve the MBE Goal(s), which, by their scope, intensity, and appropriateness to the objective, could reasonably be expected to obtain sufficient MBE participation, even if those steps were not fully successful. Whether the Offeror that requests a waiver made adequate good faith efforts will be determined by considering the quality, quantity, and intensity of the different kinds of efforts that the Offeror has made. The efforts employed by the Offeror should be those that one could reasonably expect the Offeror to take if the Offeror were actively and aggressively trying to obtain MBE participation sufficient to meet the MBE contract goal and subgoals. Mere *pro forma* efforts are not good faith efforts to meet the MBE contract requirements. The determination concerning the sufficiency of the Offeror's good faith efforts is a judgment call; meeting quantitative formulas is not required.

Identified Firms – "Identified Firms" means a list of the MBEs identified by the procuring agency during the goal setting process and listed in the procurement as available to perform the Identified Items of Work. It also may include additional MBEs identified by the Offeror as available to perform the Identified Items of Work, such as MBEs certified or granted an expansion of services after the procurement was issued. If the procurement does not include a list of Identified Firms, this term refers to all of the MBE Firms (if State-funded) the Offeror identified as available to perform the Identified Items of Work and should include all appropriately certified firms that are reasonably identifiable.

Identified Items of Work – "Identified Items of Work" means the Proposal items identified by the procuring agency during the goal setting process and listed in the procurement as possible items of work for performance by MBE Firms. It also may include additional portions of items of work the Offeror identified for performance by MBE Firms to increase the likelihood that the MBE Goal(s) will be achieved. If the procurement does not include a list of Identified Items of Work, this term refers to all of the items of work the Offeror identified as possible items of work for performance by MBE Firms and should include all reasonably identifiable work opportunities.

MBE Firms – "MBE Firms" refers to firms certified by the Maryland Department of Transportation ("MDOT") under COMAR 21.11.03. Only MDOT-certified MBE Firms can participate in the State's MBE Program.

II. Types of Actions Agency will Consider

The Offeror is responsible for making relevant portions of the work available to MBE subcontractors and suppliers and select those portions of the work or material needs consistent with the available MBE subcontractors and suppliers, so as to facilitate MBE participation. The following is a list of types of actions the procuring agency will consider as part of the Offeror's Good Faith Efforts when the Offeror fails to meet the MBE Goal(s). This list is not intended to be a mandatory checklist, nor is it intended to be exclusive or exhaustive. Other factors or types of efforts may be relevant in appropriate cases.

A. Identify Proposal Items as Work for MBE Firms

1. Identified Items of Work in Procurements

   (a) Certain procurements will include a list of Proposal items identified during the goal setting process as possible work for performance by MBE Firms. If the procurement provides a list of Identified Items of Work, the Offeror shall make all reasonable efforts to solicit quotes from MBE Firms to perform that work.

   (b) Offerors may, and are encouraged to, select additional items of work to be performed by MBE Firms to increase the likelihood that the MBE Goal(s) will be achieved.

2. Identified Items of Work by Offerors

   (a) When the procurement does not include a list of Identified Items of Work or for additional Identified Items of Work, Offerors should reasonably identify sufficient items of work to be performed by MBE Firms.

(b) Where appropriate, Offerors should break out contract work items into economically feasible units to facilitate MBE participation, rather than perform these work items with their own forces. The ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the Offeror of the responsibility to make Good Faith Efforts.

B. Identify MBE Firms to Solicit

1. MBE Firms Identified in Procurements

(a) Certain procurements will include a list of the MBE Firms identified during the goal setting process as available to perform the items of work. If the procurement provides a list of Identified MBE Firms, the Offeror shall make all reasonable efforts to solicit those MBE firms.

(b) Offerors may, and are encouraged to, search the MBE Directory to identify additional MBEs who may be available to perform the items of work, such as MBEs certified or granted an expansion of services after the solicitation was issued.

2. MBE Firms Identified by Offerors

(a) When the procurement does not include a list of Identified MBE Firms, Offerors should reasonably identify the MBE Firms that are available to perform the Identified Items of Work.

(b) Any MBE Firms identified as available by the Offeror should be certified to perform the Identified Items of Work.

C. Solicit MBEs

1. Solicit <u>all</u> Identified Firms for all Identified Items of Work by providing written notice. The Offeror should:

(a) provide the written solicitation at least 10 days prior to Proposal opening to allow sufficient time for the MBE Firms to respond;

(b) send the written solicitation by first-class mail, facsimile, or e-mail using contact information in the MBE Directory, unless the Offeror has a valid basis for using different contact information; and

(c) provide adequate information about the plans, specifications, anticipated time schedule for portions of the work to be performed by the MBE, and other requirements of the contract to assist MBE Firms in responding. (This information may be provided by including hard copies in the written solicitation or by <u>electronic means</u> as described in C.3 below.)

2. "<u>All</u>" Identified Firms includes the MBEs listed in the procurement and any MBE Firms you identify as potentially available to perform the Identified Items of Work, but it does not include MBE Firms who are no longer certified to perform the work as of the date the Offeror provides written solicitations.

3. "<u>Electronic Means</u>" includes, for example, information provided *via* a website or file transfer protocol (FTP) site containing the plans, specifications, and other requirements of the contract. If an interested MBE cannot access the information provided by electronic means, the Offeror must make the information available in a manner that is accessible to the interested MBE.

4. Follow up on initial written solicitations by contacting MBEs to determine if they are interested. The follow up contact may be made:

(a) by telephone using the contact information in the MBE Directory, unless the Offeror has a valid basis for using different contact information; or

(b) in writing *via* a method that differs from the method used for the initial written solicitation.

5. In addition to the written solicitation set forth in C.1 and the follow up required in C.4, use all other reasonable and available means to solicit the interest of MBE Firms certified to perform the work of the contract. Examples of other means include:

(a) attending any pre-Proposal meetings at which MBE Firms could be informed of contracting and subcontracting opportunities; and

(b) if recommended by the procurement, advertising with or effectively using the services of at least two minority focused entities or media, including trade associations, minority/women community organizations, minority/women contractors' groups, and local, state, and federal minority/women business assistance offices listed on the MDOT Office of Minority Business Enterprise website.

D. Negotiate with Interested MBE Firms

Offerors must negotiate in good faith with interested MBE Firms.

1. Evidence of negotiation includes, without limitation, the following:
   (a) the names, addresses, and telephone numbers of MBE Firms that were considered;
   (b) a description of the information provided regarding the plans and specifications for the work selected for subcontracting and the means used to provide that information; and
   (c) evidence as to why additional agreements could not be reached for MBE Firms to perform the work.
2. The Offeror using good business judgment would consider a number of factors in negotiating with subcontractors, including MBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration.
3. The fact that there may be some additional costs involved in finding and using MBE Firms is not in itself sufficient reason for the Offeror's failure to meet the contract MBE goal(s), as long as such costs are reasonable. Factors to take into consideration when determining whether an MBE Firm's quote is excessive or unreasonable include, without limitation, the following:
   (a) dollar difference between the MBE subcontractor's quote and the average of the other subcontractors' quotes received by the Offeror;
   (b) percentage difference between the MBE subcontractor's quote and the average of the other subcontractors' quotes received by the Offeror;
   (c) percentage that the MBE subcontractor's quote represents of the overall contract amount;
   (d) number of MBE firms that the Offeror solicited for that portion of the work;
   (e) whether the work described in the MBE and Non-MBE subcontractor quotes (or portions thereof) submitted for review is the same or comparable; and
   (f) number of quotes received by the Offeror for that portion of the work.
4. The above factors are not intended to be mandatory, exclusive, or exhaustive, and other evidence of an excessive or unreasonable price may be relevant.
5. The Offeror may not use its price for self-performing work as a basis for rejecting an MBE Firm's quote as excessive or unreasonable.
6. The "average of the other subcontractors' quotes received" by the Offeror refers to the average of the quotes received from all subcontractors. Offeror should attempt to receive quotes from at least three subcontractors, including one quote from an MBE and one quote from a Non-MBE.
7. The Offeror shall not reject an MBE Firm as unqualified without sound reasons based on a thorough investigation of the firm's capabilities. For each certified MBE that is rejected as unqualified or that placed a subcontract quotation or offer that the Offeror concludes is not acceptable, the Offeror must provide a written detailed statement listing the reasons for this conclusion. The Offeror also must document the steps taken to verify the capabilities of the MBE and Non-MBE Firms quoting similar work.
   (a) The factors to take into consideration when assessing the capabilities of an MBE Firm, include, but are not limited to the following: financial capability, physical capacity to perform, available personnel and equipment, existing workload, experience performing the type of work, conduct and performance in previous contracts, and ability to meet reasonable contract requirements.
   (b) The MBE Firm's standing within its industry, membership in specific groups, organizations, or associations and political or social affiliations (for example union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of Proposals in the efforts to meet the project goal.

E. Assisting Interested MBE Firms

When appropriate under the circumstances, the decision-maker will consider whether the Offeror Offeror made reasonable efforts to assist interested MBR Firms in obtaining:

1. The bonding, lines of credit, or insurance required by the procuring agency or the Offeror; and
2. Necessary equipment, supplies, materials, or related assistance or services.

III. Other Considerations

In making a determination of Good Faith Efforts the decision-maker may consider engineering estimates, catalogue prices, general market availability and availability of certified MBE Firms in the area in which the work is to be performed, other Proposals or offers and subcontract Proposals or offers substantiating significant variances between certified MBE and Non-MBE costs of participation, and their impact on the overall cost of the contract to the State and any other relevant factors.

The decision-maker may take into account whether the Offeror decided to self-perform subcontract work with its own forces, especially where the self-performed work is Identified Items of Work in the procurement. The decision-maker also may take into account the performance of other Offerors in meeting the contract. For example, when the apparent successful Offeror fails to meet the contract goal, but others meet it, this reasonably raises the question of whether, with additional reasonable efforts, the apparent successful Offeror could have met the goal. If the apparent successful Offeror fails to meet the goal, but meets or exceeds the average MBE participation obtained by other Offerors, this, when viewed in conjunction with other factors, could be evidence of the apparent successful Offeror having made Good Faith Efforts.

IV. Documenting Good Faith Efforts

At a minimum, the Offeror seeking a waiver of the MBE Goal(s) or a portion thereof must provide written documentation of its Good Faith Efforts, in accordance with COMAR 21.11.03.11, within 10 Business Days after receiving notice that it is the apparent awardee. The written documentation shall include the following:

A. Items of Work (Complete Good Faith Efforts Documentation Attachment D-1C, Part 1)

A detailed statement of the efforts made to select portions of the work proposed to be performed by certified MBE Firms in order to increase the likelihood of achieving the stated MBE Goal(s).

B. Outreach/Solicitation/Negotiation

1. The record of the Offeror's compliance with the outreach efforts prescribed by COMAR 21.11.03.09C(2)(a). **(Complete Outreach Efforts Compliance Statement - D-2)**.
2. A detailed statement of the efforts made to contact and negotiate with MBE Firms including:
   (a) the names, addresses, and telephone numbers of the MBE Firms who were contacted, with the dates and manner of contacts (letter, fax, e-mail, telephone, etc.) (**Complete Good Faith Efforts Attachment D-1C- Part 2, and submit letters, fax cover sheets, e-mails, etc. documenting solicitations**); and
   (b) a description of the information provided to MBE Firms regarding the plans, specifications, and anticipated time schedule for portions of the work to be performed and the means used to provide that information.

C. Rejected MBE Firms (Complete Good Faith Efforts Attachment D-1C, Part 3)

1. For each MBE Firm that the Offeror concludes is not acceptable or qualified, a detailed statement of the reasons for the Offeror's conclusion, including the steps taken to verify the capabilities of the MBE and Non-MBE Firms quoting similar work.
2. For each certified MBE Firm that the Offeror concludes has provided an excessive or unreasonable price, a detailed statement of the reasons for the Offeror's conclusion, including the quotes received from all MBE and Non-MBE firms proposing on the same or comparable work. **(Include copies of all quotes received.)**
3. A list of MBE Firms contacted but found to be unavailable. This list should be accompanied by an MBE Unavailability Certificate (see **D-1B - Exhibit A** to this Part 1) signed by the MBE contractor or a statement from the Offeror that the MBE contractor refused to sign the MBE Unavailability Certificate.

D. Other Documentation

1. Submit any other documentation requested by the Procurement Officer to ascertain the Offeror's Good Faith Efforts.
2. Submit any other documentation the Offeror believes will help the Procurement Officer ascertain its Good Faith Efforts.

D-1B - Exhibit A
MBE Subcontractor Unavailability Certificate

1. It is hereby certified that the firm of _____
(Name of Minority firm)

located at _____
(Number) (Street)

_____
(City) (State) (Zip)

was offered an opportunity to bid on Solicitation No. _____

in _____ County by _____
(Name of Prime Contractor's Firm)

****

2. _____ (Minority Firm), is either unavailable for the work/service or unable to prepare a Proposal for this project for the following reason(s):

_____

_____

_____

_____

****

_____

(Signature of Minority Firm's MBE Representative) (Title) (Date)

_____

(MDOT Certification #) (Telephone #)

****

3. To be completed by the prime contractor if Section 2 of this form is not completed by the minority firm.

To the best of my knowledge and belief, said Certified Minority Business Enterprise is either unavailable for the work/service for this project, is unable to prepare a Proposal, or did not respond to a request for a price Proposal and has not completed the above portion of this submittal.

_____

(Signature of Prime Contractor) (Title) (Date)

D-1C
GOOD FAITH EFFORTS DOCUMENTATION TO SUPPORT WAIVER REQUEST

PAGE __ OF ___

Prime Contractor:	**Project Description:**	**PROJECT/CONTRACT**
Offeror Company Name, Street Address, Phone		**Solicitation:** TI - AWP-SI

Parts 1, 2, and 3 must be included with this certificate along with all documents supporting your waiver request.

I affirm that I have reviewed **Attachment D-1B**, Waiver Guidance. I further affirm under penalties of perjury that the contents of Parts 1, 2, and 3 of this **Attachment D-1C** Good Faith Efforts Documentation Form are true to the best of my knowledge, information, and belief.

Company:

Company Name (please print or type)

By:

Signature of Authorized Representative

Printed Name:

Printed Name

Title:

Title

Date:

Date

Address:

Company Address

GOOD FAITH EFFORTS DOCUMENTATION TO SUPPORT WAIVER REQUEST

PART 1 – IDENTIFIED ITEMS OF WORK OFFEROR MADE AVAILABLE TO MBE FIRMS

PAGE __ OF ___

Prime Contractor:	**Project Description:**	**PROJECT/CONTRACT**
Offeror Company Name, Street Address, Phone		**Solicitation:** TI - AWP-SI

Identify those items of work that the Offeror made available to MBE Firms. This includes, where appropriate, those items the Offeror identified and determined to subdivide into economically feasible units to facilitate the MBE participation. For each item listed, show the anticipated percentage of the total contract amount. It is the Offeror's responsibility to demonstrate that sufficient work to meet the goal was made available to MBE Firms, and the total percentage of the items of work identified for MBE participation equals or exceeds the percentage MBE goal set for the procurement. Note: If the procurement includes a list of Proposal items identified during the goal setting process as possible items of work for performance by MBE Firms, the Offeror should make all of those items of work available to MBE Firms or explain why that item was not made available. If the Offeror selects additional items of work to make available to MBE Firms, those additional items should also be included below.

Identified Items of Work	**Was this work listed in the procurement?**	**Does Offeror normally self-perform this work?**	**Was this work made available to MBE Firms? If no, explain why not.**
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No
	□ Yes □ No	□ Yes □ No	□ Yes □ No

☐ Please check if Additional Sheets are attached.

GOOD FAITH EFFORTS DOCUMENTATION TO SUPPORT WAIVER REQUEST

PART 2 – IDENTIFIED MBE FIRMS AND RECORD OF SOLICITATIONS

PAGE __ OF ___

Prime Contractor:	**Project Description:**	**PROJECT/CONTRACT**
Offeror Company Name, Street Address, Phone		**Solicitation:** TI - AWP-SI

Identify the MBE Firms solicited to provide quotes for the Identified Items of Work made available for MBE participation. Include the name of the MBE Firm solicited, items of work for which quotes were solicited, date and manner of initial and follow-up solicitations, whether the MBE provided a quote, and whether the MBE is being used to meet the MBE participation goal. MBE Firms used to meet the participation goal must be included on the MBE Participation Schedule. Note: If the procurement includes a list of the MBE Firms identified during the goal setting process as potentially available to perform the items of work, the Offeror should solicit all of those MBE Firms or explain why a specific MBE was not solicited. If the Offeror identifies additional MBE Firms who may be available to perform Identified Items of Work, those additional MBE Firms should also be included below. Copies of all written solicitations and documentation of follow-up calls to MBE Firms must be attached to this form. This list should be accompanied by a Minority Contractor Unavailability Certificate signed by the MBE contractor or a statement from the Offeror that the MBE contractor refused to sign the Minority Contractor Unavailability Certificate (**Attachment D-1B - Exhibit A**). If the Offeror used a Non-MBE or is self-performing the identified items of work, Part 4 must be completed.

Name of Identified MBE Firm & MBE Classification	**Describe Item of Work Solicited**	**Initial Solicitation Date & Method**	**Follow-up Solicitation Date & Method**	**Details for Follow-up Calls**	**Quote Rec'd**	**Quote Used**	**Reason Quote Rejected**
Firm Name: MBE Classification (Check only if requesting waiver of MBE subgoal.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification _____		Date: □ Mail □ Facsimile □ E-mail	Date: □ Phone □ Mail □ Facsimile □ E-mail	Time of Call: Spoke with: _____ □ Left Message	□ Yes □ No	□ Yes □ No	□ Used Other MBE □ Used Non-MBE □ Self-performing
Firm Name: MBE Classification (Check only if requesting waiver of MBE subgoal.) ☐ African American-Owned ☐ Hispanic American- Owned ☐ Asian American-Owned ☐ Women-Owned ☐ Other MBE Classification _____		Date: □ Mail □ Facsimile □ E-mail	Date: □ Phone □ Mail □ Facsimile □ E-mail	Time of Call: Spoke with: _____ □ Left Message	□ Yes □ No	□ Yes □ No	□ Used Other MBE □ Used Non-MBE □ Self-performing

☐ Please check if Additional Sheets are attached.

GOOD FAITH EFFORTS DOCUMENTATION TO SUPPORT WAIVER REQUEST

PART 3 – ADDITIONAL INFORMATION REGARDING REJECTED MBE QUOTES

PAGE __ OF ___

Prime Contractor:	**Project Description:**	**PROJECT/CONTRACT NUMBER:**
Offeror Company Name, Street Address, Phone		**Solicitation:** TI - AWP-SI

This form must be completed if Part 1 indicates that an MBE quote was rejected because the Offeror is using a Non-MBE or is self-performing the Identified Items of Work. Provide the Identified Items Work, indicate whether the work will be self-performed or performed by a Non-MBE, and if applicable, state the name of the Non-MBE. Also include the names of all MBE and Non-MBE Firms that provided a quote and the amount of each quote.

Describe Identified Items of Work Not Being Performed by MBE (Include spec/ section number from Proposal)	**Self-performing or Using Non-MBE (Provide name)**	**Amount of Non-MBE Quote**	**Name of Other Firms who Provided Quotes & Whether MBE or Non-MBE**	**Amount Quoted**	**Indicate Reason Why MBE Quote Rejected & Briefly Explain**
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other
	□ Self-performing □ Using Non-MBE _____	$_____	_____ □ MBE □ Non-MBE	$_____	□ Price □ Capabilities □ Other

☐ Please check if Additional Sheets are attached.

D- 2
OUTREACH EFFORTS COMPLIANCE STATEMENT

Complete and submit this form within 10 Business Days of notification of apparent award or actual award, whichever is earlier.

In conjunction with the Proposal submitted in response to Solicitation No. _____, I state the following:

1. Offeror identified subcontracting opportunities in these specific work categories:

_____

_____

_____

2. Attached to this form are copies of written solicitations (with Proposal instructions) used to solicit certified MBE firms for these subcontract opportunities.

3. Offeror made the following attempts to personally contact the solicited MDOT-certified MBE firms:

_____

_____

_____

4. **Please Check One:**

□ This project does not involve bonding requirements.

□ Offeror assisted MDOT-certified MBE firms to fulfill or seek waiver of bonding requirements. (DESCRIBE EFFORTS):

_____

_____

_____

5. **Please Check One:**

_____ Offeror did attend the pre-Proposal conference.

_____ No pre -Proposal meeting/conference was held.

_____ Offeror did not attend the pre-Proposal conference.

PLEASE PRINT OR TYPE

Company:

Company Name (please print or type)

By:

Signature of Authorized Representative

Printed Name:

Printed Name

Title:

Title

Date:

Date

Address:

Company Address

D-3A
CERTIFED MBE SUBCONTRACTOR PARTICIPATION CERTIFICATION

INSTRUCTIONS:

PRIME CONTRACTOR: After completing SECTIONS A, B, and D, provide this form to ***each*** certified Minority Business Enterprise subcontractor (MBE) listed on the MBE Participation Schedule (Attachment D-1A) allowing sufficient time for the MBE to respond within the required timeframe.

CERTIFIED MBE SUBCONTRACTOR: Complete SECTION C to acknowledge and certify the information in SECTION A. Return the completed form directly to the Procurement Officer identified in SECTION D within 10 days after notice from the Prime Contractor of the State's intent to award the Contract. Provide a copy to the Prime Contractor.

IF THIS FORM IS NOT RETURNED WITHIN THE REQUIRED TIME, THE PROCUREMENT OFFICER MAY DETERMINE THAT THE PRIME CONTRACTOR IS NOT RESPONSIBLE AND THEREFORE NOT ELIGIBLE FOR CONTRACT AWARD.

SECTION A

Provided that (Prime Contractor) _____ is awarded the State contract in conjunction with Solicitation Number _____, (Prime Contractor) _____ intends to enter into a subcontract with (Certified MBE Subcontractor) _____ with MDOT Certification Number _____ committing to participation by (Certified MBE Subcontractor) _____ of at least $_____ which equals _____% of the Total Contract Value for the following products/services:

NAICS CODE	WORK ITEM, SPECIFICATION NUMBER, LINE ITEMS OR WORK CATEGORIES (IF APPLICABLE)	DESCRIPTION OF SPECIFIC PRODUCTS AND/OR SERVICES

The Contractor and certified MBE each acknowledge that, for purposes of determining the accuracy of the information provided herein, the Procurement Officer may request additional information, including, without limitation, copies of the subcontract agreements and quotes. The Contractor and certified MBE each solemnly affirms under the penalties of perjury that: (i) the information provided in this Certified MBE Subcontractor Participation Certification is true to the best of its knowledge, information and belief, and (ii) it has fully complied with the State Minority Business Enterprise law, State Finance and Procurement Article §14-308(a)(2), Annotated Code of Maryland which provides that, except as otherwise provided by law, a Contractor may not identify a certified MBE in a Bid/Proposal and:

(1) fail to request, receive, or otherwise obtain authorization from the MBE to identify the MBE in its Bid/Proposal;

(2) fail to notify the MBE before execution of the Contract of its inclusion of the Bid/Proposal;

(3) fail to use the MBE in the performance of the Contract; or

(4) pay the MBE solely for the use of its name in the Bid/Proposal.

SECTION B – Prime Contractor

Signature of Representative:

_____

Printed Name and Title:

_____

Prime Firm's Name: _____

Federal Identification Number: _____

Street Address, City, State, Zip Code:

_____

_____

Phone: _____

Date: _____

SECTION C – Certified MBE Subcontractor

Signature of Representative:

_____

Printed Name and Title:

_____

MBE Firm's Name: _____

Federal Identification Number: _____

Street Address, City, State, Zip Code:

_____

_____

Phone: _____

Date: _____

SECTION D

This completed form is due to the Procurement Officer on or before: _____

Solicitation #: N/A

Solicitation Title: TI - Arthur Perdue Stadium Improvements

Agency/Dept.: Maryland Stadium Authority

Procurement Officer: Christian Kramer

Phone: 443-202-3885 Email: ckramer@mdstad.com

Street Address, City, State, Zip Code: 351 W. Camden Street, Suite 300, Baltimore, Maryland 21201

D-3B
MBE PRIME PROJECT PARTICIPATION CERTIFICATION

Please complete and submit this form to attest to each specific item of work that your MBE firm has listed on the MBE Participation Schedule (Attachment D-1A) for purposes of meeting the MBE participation goals. This form must be submitted within 10 Business Days of notification of apparent award. If the Offeror fails to return this affidavit within the required time, the Procurement Officer may determine that Proposal is not susceptible of being selected for Contract award.

Provided that _____ (Prime Contractor's Name) with Certification Number _____ is awarded the State contract in conjunction with Solicitation No. _____, such MBE Prime Contractor intends to perform with its own forces at least $_____ which equals to___% of the Total Contract Amount for performing the following goods and services for the Contract:

NAICS CODE	WORK ITEM, SPECIFICATION NUMBER, LINE ITEMS OR WORK CATEGORIES (IF APPLICABLE) For Construction Projects, General Conditions must be listed separately	DESCRIPTION OF SPECIFIC PRODUCTS AND/OR SERVICES	VALUE OF THE WORK

MBE Prime Contractor

Company: _____

Company Name (please print or type)

FEIN: _____

Federal Identification Number

Company Address: _____

_____

Phone: _____

Printed Name: _____

Title: _____

By: _____

Signature of Authorized Representative

Date: _____

D-4A
Minority Business Enterprise Participation
Prime Contractor Paid/Unpaid Invoice Report

Report #:	Contract #:
Reporting Period (Month/Year):	Contracting Unit:
Prime Contractor: Report is due to the MBE Liaison by the 10th of the month following the month the services were provided. **Note: Please number reports in sequence**	Contract Amount: MBE Subcontract Amt: Project Begin Date: Project End Date: Services Provided:

Prime Contractor:		Contact Person:	
Address:			
City:		State:	ZIP:
Phone:	FAX:	E-mail:	
MBE Subcontractor Name:		Contact Person:	
Phone:	FAX:	E-mail:	
Subcontractor Services Provided:			

List all payments made to MBE subcontractor named above during this reporting period:			**List dates and amounts of any outstanding invoices:**		
	Invoice #	**Amount**		**Invoice #**	**Amount**
1.			1.		
2.			2.		
3.			3.		
4.			4.		
Total Dollars Paid: $			**Total Dollars Unpaid: $**		

- If more than one MBE subcontractor is used for this contract, you must use separate **Attachment D-4A** forms. Information regarding payments that the MBE prime will use for purposes of meeting the MBE participation goals must be reported separately in **Attachment D-4B**.
- **Return one copy (hard or electronic) of this form to the following addresses (electronic copy with signature and date is preferred):**

Contract Monitor Name	Contracting Unit
Address	City, State Zip
Email	Phone Number
Signature (Required)	Date

D-4B
Minority Business Enterprise Participation
MBE Prime Contractor Report

MBE Prime Contractor:	Contract #:
Certification Number:	Contracting Unit:
Report #:	Contract Amount:
Reporting Period (Month/Year):	Total Value of the Work to the Self-Performed for purposes of Meeting the MBE participation goal/subgoals:
MBE Prime Contractor: Report is due to the MBE Liaison by the 10th of the month following the month the services were provided. **Note: Please number reports in sequence**	Project Begin Date:
	Project End Date:

Contact Person:			
Address:			
City:		State:	ZIP:
Phone:	FAX:	E-mail:	

Invoice Number	**Value of the Work**	**NAICS Code**	**Description of Specific Products and/or Services**

Return one copy (hard or electronic) of this form to the following addresses (electronic copy with signature and date is preferred):

Contract Monitor Name	Contracting Unit
Address	City, State Zip
Email	Phone Number
Signature (Required)	Date

D-5
Minority Business Enterprise Participation
MBE Subcontractor Paid/Unpaid Invoice Report

Report #:	Contract #:
Reporting Period (Month/Year):	Contracting Unit:
Report is due by the 10th of the month following the month the services were performed.	MBE Subcontract Amt:
	Project Begin Date:
	Project End Date:
	Services Provided:

MBE Subcontractor Name:			
MDOT Certification #:			
Contact Person:			
Address:			
City:		State:	ZIP:
Phone:	FAX:	E-mail:	
Subcontractor Services Provided:			

List all payments received from Prime Contractor during reporting period indicated above.			**List dates and amounts of any unpaid invoices over 30 days old.**		
	Invoice Amount	**Date**		**Invoice Amount**	**Date**
1.			1.		
2.			2.		
3.			3.		
4.			4.		
Total Dollars Paid: $			**Total Dollars Unpaid: $**		
Prime Contractor:			Contract Person:		

Return one copy of this form to the following addresses (electronic copy with signature and date is preferred):

Contract Monitor Name	Contracting Unit
Address	City, State Zip
Email	Phone Number
Signature (Required)	Date

ATTACHMENT E

CORPORATE PROFILE

Consultant Corporate Profile

Firm Contact Information

Firm Name: _____

Federal ID Number: _____

Point of Contact: _____ Phone Number: _____

Regional Office Address: _____

_____

Firm Background Information

Year Firm Founded: _____

Is the firm MDOT MBE Certified? Yes/No

If certified, provide the certification number and minority status.

_____

Primary Business / Service Provided: _____

Number of Years Performing Services: _____

Number Full Time Employees (Corporate / Regional Office): _____/_____

Provide a brief narrative outlining the firm's history.

_____

_____

_____

_____

_____

_____

_____

Provide a brief narrative outlining what services the firm intends to self-perform.

_____

_____

_____

_____

_____

_____

CONFIDENTIAL

Provide a brief narrative outlining what services the firm intends to subcontract to others.

Provide a brief narrative outlining the firm's familiarity with standards, laws and conditions as they apply to the work to be performed under this project.

Provide a brief narrative clarifying the firm's capacity to perform services as outlined in the RFP.

Provide sales volume and project completion data for the most recently completed three-year period. Note that information provided is to be for the regional / local office that would be responsible for completing work under this solicitation.

Volume	Annual Sales	Completed Projects	Largest Project
2020			
2021			
2022			
2023			

CONFIDENTIAL

Firm References

Provide three (3) references. Note that references are to be from different projects; that is, only one reference per project is allowed. **MSA staff members cannot be considered as a firm's reference.**

Project Name:_____

Name: _____
Title: _____
Company Name: _____
Phone Number and email: _____
Project Relationship: _____

Project Name:_____

Name: _____
Title: _____
Company Name: _____
Phone Number and email: _____
Project Relationship: _____

Project Name:_____

Name: _____
Title: _____
Company Name: _____
Phone Number and email: _____
Project Relationship: _____

CONFIDENTIAL

Disclosure of Contract Issues; Litigation; Criminal Investigations

In the last five years, list and discuss any alleged prior or ongoing contract failures (potential judgment/settlement in excess of $100,000), contract breaches (potential judgment/settlement in excess of $100,000), other significant civil litigation, and all criminal litigation or investigations, which involved your firm.

Failure to Complete

In the last five (5) years, disclose any projects that your firm was involved with that were not completed.

Insurance

Include current certificates of insurance showing the limits of liability maintained by your firm in each of the following categories: workers' compensation, employer's liability, commercial general liability, automobile liability, umbrella or excess liability, and property insurance.

CONFIDENTIAL

Prepared By:

Name:_____

Title: _____

Signature:_____

Date: _____

CONFIDENTIAL

ATTACHMENT F

STAFFING PLAN

To be issued via addendum.

ATTACHMENT G

CAPACITY SUMMARY SHEET

CAPACITY SUMMARY SHEET FOR KEY MANAGEMENT AND PERSONNEL

Name of Firm:
RFP Title: Testing and Inspection Services - Arthur Perdue Stadium Improvements

In this table, your firm must include information for all key management and other personnel (**including subconsultants**) who were listed as part of the project team in the Work Plan. Please add rows as necessary.

Name/Position Description (must be consistent with Financial Proposal)	Current and Projected Assignments	Value of Contract	Role on Current and Projected Assignments	NTP Date	Approx. Completion Date	Project on Schedule (Y/N)	Committed hours for the next 24 months	Identify issues which may affect individual's ability to perform the services described in this RFP. Indicate if a current project is high-priority/rush. If project is behind schedule, provide brief explanation.
					Total		0	
					Total		0	

ATTACHMENT H

PRICING FORM

To be issued via addendum.

ATTACHMENT I
PROJECT EXPERIENCE FORM

Request for Proposals (RFP)
Testing and Inspection Services
Arthur Perdue Stadium Improvements

Project Experience Form TI

	PROJECT #1	PROJECT #2	PROJECT #3
Project Name and Location			
Owner Name, Contact Person, Email & Phone Number			
Offeror's Role in the Project			
Project Type (New, Renovation, etc.)			
Gross Square Footage of Project			
Project Delivery Method (CMR, CM Agency, DB, Negotiatied GMP, GC, etc.)			
Similarities/Relevance to this Project			
Original Completion Date			
Actual Completion Date			
Reason(s) for Variance (if applicable)			
Original Construction Cost			
Final Construction Cost			
Reason(s) for Cost Difference (if applicable)			
Offeror's Original Contract Amount			
Offeror's Final Contract Amount			
Reason(s) for Cost Difference (if applicable)			
Preconstruction Services Provided (Yes / No. If Yes, detail the level of serivces provided.)			
Construction Services Provided (Yes / No. If yes detail the level of services provided.)			
Project Executive			
Project Manager			
Field Superintendent			
Project Scheduler			

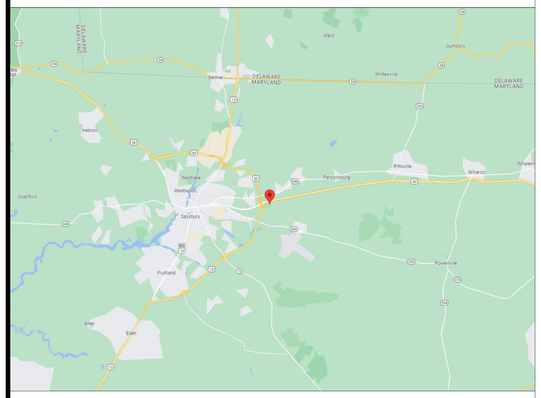
ATTACHMENT J

70% CONSTRUCTION DOCUMENTS

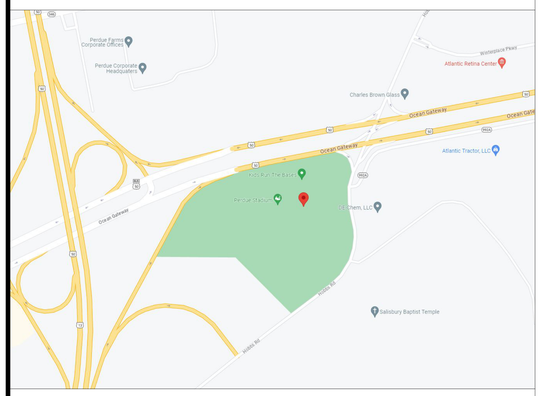
ATTACHMENT J.1

70% DRAWINGS

AREA MAP

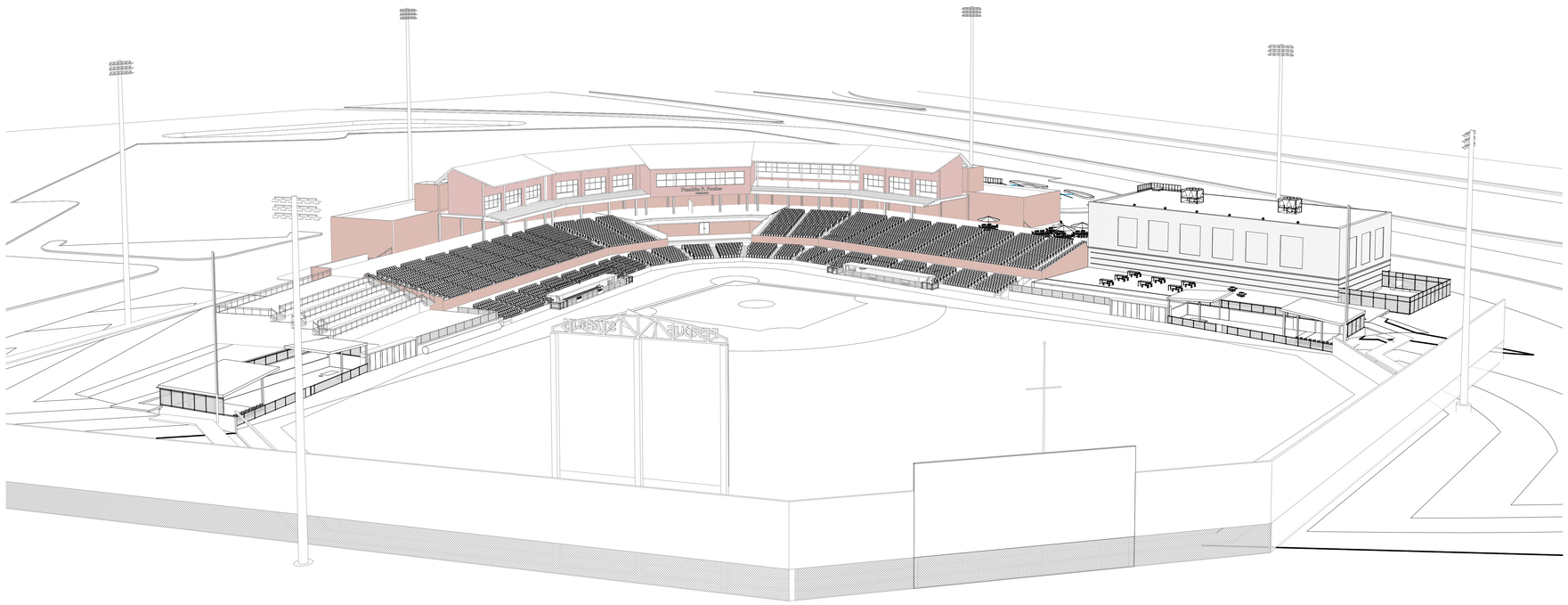


LOCATION MAP



ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD
SALISBURY, MD 21804



DESIGN BUILDER:
GILBANE BUILDING COMPANY
1215 E Fort Ave
Baltimore, MD 21230
Phone: 410.649.1750

ARCHITECT:
EWINGCOLE
810 Light Street
Baltimore, MD 21230
Phone: 410.837.5040

STRUCTURAL ENGINEER:
EWINGCOLE
810 Light Street
Baltimore, MD 21230
Phone: 410.837.5040

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING
119 Naylor Mill Road, Suite 3
Salisbury, MD, 21801
Phone: 410.548.1492

MEPFP ENGINEERS:
WFT ENGINEERING, INC
1801 Research Blvd., Suite 100
Rockville MD, 20850
Phone: 301.230.0811

ACOUSTIC & AV CONSULTANT:
CONVERGENT TECHNOLOGIES DESIGN GROUP
6501 York Road
Baltimore, MD 21212
Phone: 410.532.2396

MARYLAND STADIUM AUTHORITY
Est. 1986

MARYLAND STADIUM AUTHORITY

351 WEST CAMDEN STREET, SUITE 300
BALTIMORE, MD 21201

70% CD SUBMISSION
June 21, 2024

NOT FOR CONSTRUCTION

Design Build Team

EWING COLE

Gilbane

InSite|BUILD

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DRAWN BY	EC	DATE	
PROJECT NO.	20230573	SCALE	
DRAWING NAME			
COVER SHEET			
PHASE		DRAWING NO.	
CD		CS	

6/26/2024 4:24:06 PM C:\Users\snjuguna\OneDrive - EwingCole\Documents\Perdue Stadium - 2024_snjuguna\HULY6.rvt

ARCH - DRAWING LIST

Sheet Number	Sheet Name	SD SUBMISSION - 35 % COMPLETE 03-18-2024	DD SUBMISSION - 50 % COMPLETE 05-09-2024	STEEL - 06-04-2024	CD SUBMISSION - 70 % COMPLETE 06-21-2024
General					
CS	COVER SHEET	X	X		X
G.0	DRAWING LIST	X	X		X
G.1	ABBREVIATIONS & SYMBOL LIST	X	X		X
G.2	CODE STUDY	X	X		X
Life Safety					
LS2.1	HOME CLUBHOUSE LIFE SAFTEY PLAN	X	X		X
LS2.2	VISITOR CLUBHOUSE LIFE SAFTEY PLAN	X	X		X
Civil					
C1	COVER SHEET		X		X
C2	OVERALL EXISTING CONDITIONS PLAN	X	X		X
C3	EXISTING CONDITIONS PLAN	X	X		X
C4	EXISTING CONDITIONS PLAN	X	X		X
C5	EXISTING CONDITIONS PLAN		X		X
C6	DEMOLITION PLAN	X	X		X
C7	DEMOLITION PLAN	X	X		X
C8	OVERAL SITE PLAN	X	X		X
C9	SITE PLAN		X		X
C10	SITE PLAN		X		X
C11	SITE DETAILS		X		X
C12	GRADING PLAN				X
C13	GRADING PLAN				X
C14	STORM WATER MANAGEMENT PLAN		X		X
C15	STORM WATER MANAGEMENT DETAILS		X		X
C16	EROSION & SEDIMENT CONTROL PLAN				X
C17	EROSION &SEDIMENT CONTROL PLAN				X
C18	EROSION & SEDIMENT CONTROL DETAILS		X		X
C19	EROSION & SEDIMENT CONTROL DETAILS		X		X
C20	EROSION & SEDIMENT CONTROL DETAILS				X
Architectural					
AG.3	MOUNTING HEIGHTS & CLEARANCES	X	X		X
AG.4	CODE REQUIRED SIGNAGE	X	X		X
AD2.1.1	HOME CLUBHOUSE-DEMO PLAN	X	X		X
AD2.1.2	VISITOR CLUBHOUSE - DEMO PLAN	X	X		X
AD2.2.1	HOME CLUBHOUSE-DEMO RCP		X		X
AD2.2.2	VISITOR CLUBHOUSE - DEMO RCP		X		X
A1.1	CLUBHOUSE REFERENCE PLAN	X	X		X
A1.2	CLUBHOUSE ROOF REFERENCE PLAN		X		X
A2.1.1	HOME CLUBHOUSE PLAN	X	X		X
A2.1.2	VISITOR CLUBHOUSE PLAN	X	X		X
A2.1.3	HOME BULLPEN PLAN	X	X		X
A2.1.4	VISITOR BULLPEN PLAN	X	X		X
A2.1.5	BATTING ARENA PLAN	X	X		X
A2.1.6	BATTING ARENA ROOF PLAN		X		X
A2.1.7	HOME & VISITOR DUGOUT PLANS & SECTION		X		X
A2.1.8	HOME & VISITOR PARTIAL ROOF PLANS		X		X
A2.3.1	HOME CLUBHOUSE FURNITURE PLAN	X	X		X
A2.3.2	VISITOR CLUBHOUSE FURNITURE PLAN	X	X		X
A3.1.1	EXTERIOR ELEVATIONS	X	X		X
A3.1.2	EXTERIOR ELEVATIONS	X	X		X
A3.3.1	BUILDING SECTIONS	X	X		X
A3.3.2	BUILDING SECTIONS	X	X		X
A3.4.1	ENLARGED BUILDING SECTIONS		X		X
A3.5.1	WALL SECTIONS	X	X		X
A3.5.2	WALL SECTIONS		X		X
A3.6.1	WALL SECTION DETAILS		X		X
A3.6.2	WALL SECTION DETAILS		X		X
A3.7.1	EXTERIOR PLAN DETAILS		X		X
A4.1.1	PARTITION TYPES		X		X
A4.2.1	DOOR SCHEDULES & DETAILS		X		X
A5.1.1	ENLARGED PLANS		X		X
A5.1.2	ENLARGED PLANS		X		X
A6.1.1	INTERIOR ELEVATIONS		X		X
A6.1.2	INTERIOR ELEVATIONS		X		X
A6.1.3	INTERIOR ELEVATIONS		X		X
A7.1.A	HOME CLUBHOUSE RCP		X		X
A7.1.B	VISITOR CLUBHOUSE RCP		X		X
A7.2	BATTING ARENA RCP				X
A9.1.1	FINISH SCHEDULE		X		X

ARCH - DRAWING LIST

Sheet Number	Sheet Name	SD SUBMISSION - 35 % COMPLETE 03-18-2024	DD SUBMISSION - 50 % COMPLETE 05-09-2024	STEEL - 06-04-2024	CD SUBMISSION - 70 % COMPLETE 06-21-2024
Structural					
SG.1	STRUCTURAL GENERAL NOTES AND DRAWING LIST		X	X	X
SG.2	STRUCTURAL DESIGN CRITERIA, ABBREVIATIONS, AND NOTES		X	X	X
S2.1.A	HOME CLUBHOUSE FLOOR-FOUNDATION PLAN		X		X
S2.1.B	VISITOR CLUBHOUSE FLOOR FOUNDATION PLAN		X		X
S2.1.C	HOME BULLPEN FOUNDATION PLAN		X		X
S2.1.D	VISITOR BULLPEN FOUNDATION PLAN		X		X
S2.1.E	BATTING ARENA ADDITION FLOOR FOUNDATION PLAN		X		X
S2.2.A	BATTING ARENA ADDITION CONCOURSE LEVEL FRAMING PLAN		X		X
S2.3.A	BATTING ARENA ADDITION ROOF FRAMING PLAN		X	X	X
S2.3.B	CLUBHOUSE EXISTING ROOF FRAMING PLAN				X
S3.1.1	FOUNDATION SECTIONS		X		X
S3.1.2	FOUNDATION SECTIONS		X		X
S3.2.1	SECTIONS		X	X	X
S4.1.1	COLUMN SCHEDULE AND DETAILS		X	X	X
S4.1.2	SCHEDULES		X		X
S5.1.1	TYPICAL DETAILS		X		X
S5.2.1	TYPICAL DETAILS		X		X
Mechanical					
M0.1	SYMBOLS, ABBREVIATIONS AND NOTES		X		X
MD1.1.1	HOME CLUBHOUSE - DEMO PLAN - MECHANICAL		X		X
MD1.1.2	VISITOR CLUBHOUSE - DEMO PLAN - MECHANICAL		X		X
MD1.1.3	CLUBHOUSE ROOF - DEMO PLANS - MECHANICAL		X		X
M1.1.1	HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL		X		X
M1.1.2	VISITOR CLUBHOUSE NEW WORK PLAN - MECHANICAL		X		X
M1.1.5	HOME CLUBHOUSE BATTING ARENA PLAN - MECHANICAL		X		X
M1.1.6	HOME CLUBHOUSE BATTING ARENA ROOF PLAN - MECHANICAL		X		X
M1.1.7	CLUBHOUSE ROOF NEW WORK PLANS - MECHANICAL		X		X
M1.1.8	HOME & VISITOR DUGOUT PLANS - MECHANICAL				X
M7.1.1	MECHANICAL SCHEDULES		X		X
M7.1.2	MECHANICAL SCHEDULES AND DIAGRAMS - VRV SYSTEM				X
Plumbing					
P0.01	SYMBOLS, ABBREVIATIONS AND NOTES		X		X
PD1.1.1	HOME CLUBHOUSE - DEMO PLAN - PLUMBING		X		X
PD1.1.2	VISITOR CLUBHOUSE - DEMO PLAN - PLUMBING		X		X
P1.1.1	HOME CLUBHOUSE NEW WORK PLAN - PLUMBING		X		X
P1.1.2	VISITOR CLUBHOUSE NEW WORK PLAN - PLUMBING		X		X
P1.1.3	HOME CLUBHOUSE NEW WORK PLAN – SANITARY				X
P1.1.4	VISITOR CLUBHOUSE NEW WORK PLAN – SANITARY				X
Electrical					
E0.01	SYMBOLS, ABBREVIATIONS AND NOTES		X		X
ED1.1	DEMO SITE PLAN - ELECTRICAL		X		X
ED1.1.1	HOME CLUBHOUSE - DEMO PLAN - POWER		X		X
ED1.1.2	VISITOR CLUBHOUSE - DEMO PLAN - POWER		X		X
E1.1	NEW WORK SITE PLAN - ELECTRICAL				X
E1.1.1	HOME CLUBHOUSE NEW WORK PLAN - POWER		X		X
E1.1.2	VISITOR CLUBHOUSE NEW WORK PLAN - POWER		X		X
E1.1.3	HOME CLUBHOUSE BATTING ARENA PLAN - POWER				X
E1.1.4	HOME BULLPEN PLAN - POWER				X
E1.1.5	VISITOR BULLPEN PLAN - POWER		X		X
E1.1.6	HOME & VISITOR DUGOUT PLANS - POWER				X
E2.1.1	VISITOR CLUBHOUSE NEW WORK PLAN - LIGHTING		X		X
E2.1.2	HOME CLUBHOUSE NEW WORK PLAN - LIGHTING		X		X
E2.1.3	HOME CLUBHOUSE BATTING ARENA - LIGHTING		X		X
E2.1.4	HOME & VISITOR CLUBHOUSE NEW WORK PLAN - LIGHTING				X
E3.1.1	HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER		X		X
E3.1.2	VISTOR CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER		X		X
E3.1.3	HOME CLUBHOUSE BATTING ARENA - MECHANICAL POWER		X		X
E5.1.1	ONE-LINE - DEMOLITION		X		X
E5.1.2	ONE-LINE - NEW WORK		X		X
E7.1.1	PANEL SCHEDULES		X		X
E7.1.2	PANEL SCHEDULES		X		X
Telecom					
TA001	LOW VOLTAGE SYSTEMS TITLESHEET				X
TA002	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS				X
TA003	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS				X
TA004	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS				X
TA006	TELECOM RISER DIAGRAM				X
TA101	PLANS - HOME CLUBHOUSE				X
TA102	PLANS - VISITOR CLUBHOUSE				X
TA103	PLANS - BATTING TUNNELS				X
TA104	PLANS - BULLPENS, DUGOUTS, SECURITY FEED ROOM				X
TA700	AUDIOVISUAL SIGNAL FLOWS				X
Fire Alarm					
FA0.01	SYMBOLS, ABBREVIATIONS AND NOTES		X		X
FAD1.1.1	HOME CLUBHOUSE - DEMO PLAN - FIRE ALARM		X		X
FAD1.1.2	VISITOR CLUBHOUSE - DEMO PLAN - FIRE ALARM		X		X
FA1.1.1	HOME CLUBHOUSE NEW WORK PLAN - FIRE ALARM		X		X
FA1.1.2	VISITOR CLUBHOUSE NEW WORK PLAN - FIRE ALARM		X		X
FA1.1.5	HOME CLUBHOUSE BATTING ARENA PLAN - FIRE ALARM		X		X
FA1.1.12	CLUBHOUSE ROOF NEW WORK PLANS - FIRE ALARM		X		X
Fire Protection					
FP0.01	SYMBOLS, ABBREVIATIONS AND NOTES		X		X
FPD1.1.1	HOME CLUBHOUSE - DEMO PLAN - FIRE PROTECTION		X		X
FPD1.1.2	VISITOR CLUBHOUSE - DEMO PLAN - FIRE PROTECTION		X		X
FP1.1.1	HOME CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION		X		X
FP1.1.2	VISITOR CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION		X		X
FP1.1.5	HOME CLUBHOUSE BATTING ARENA PLAN - FIRE PROTECTION		X		X

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KEY PLAN

PRINCIPAL
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PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

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A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE

DRAWING NAME

DRAWING LIST

PHASE CD

DRAWING NO. G.0

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GENERAL ABBREVIATIONS

Ø	DIAMETER	EF	EACH FACE	L	LONG	REINF	REINFORCE(D)(ING)(MENT)
&	AND	EIFS	EXTERIOR INSULATION & FINISH SYSTEM	LAB	LABORATORY	REQD	REQUIRED
@	AT	EJ	EXPANSION JOINT	LAM	LAMINATE(D)(ION)	RES	RESILIENT
#	NUMBER, POUND	EL	ELEVATION (GRADE, FLOOR)	LAT TIE	LATERAL TIEBACK FOR APC PANEL	RET	RETAINING, RETURN
±	APPROXIMATELY	ELEC	ELECTRIC(AL)	LAV	LAVATORY	REV	REVISION
(E)	EXISTING	ELEV	ELEVATION (BLDG), ELEVATOR	LB	POUND	RFG	ROOFING
		EMBMT	EMBEDMENT	LIN	LINEAR	RJ	RUSTICATION JOINT
AB	ANCHOR BOLT	EMER	EMERGENCY	LKR	LOCKER	RLG	RAILING
ABR	ABRASIVE	ENCL	ENCLOSURE	LL	LIVE LOAD, LEAD LINED	RM	ROOM
ABV	ABOVE	ENGR	ENGINEER(ING)	LLH	LONG LEG HORIZONTAL	RO	ROUGH OPENING
AC	AIR CONDITIONING	ENTR	ENTRANCE	LLV	LONG LEG VERTICAL	RS	RESILIENT SHEET
ACC	ACCESS(IBLE)	EP	ELECTRICAL PANELBOARD	LP	LIGHT PROOF, LOW PRESSURE, LOW POINT	RT	RESILIENT TILE
ACIP	ARCHITECTURAL CAST IN PLACE CONCRETE	EQ	EQUAL	LTG	LIGHTING	RWC	RAIN WATER CONDUCTOR
ACOUS	ACOUSTIC(AL)	EQUIP	EQUIPMENT	LVR	LOUVER		
ACT	ACOUSTICAL CEILING TILE	EW	EACH WAY			SAFB	SOUND ATTENUATION FIRE BLANKET
AD	AREA DRAIN	EWC	ELECTRIC WATER COOLER	M	METER	SAN	SANITARY
ADH	ADHESIVE	EWS	EYE WASH STATION	M	MEN'S	SB	SPLASH BLOCK
ADJ	ADJACENT, ADJUSTABLE	EXH	EXHAUST	MACH	MACHINE	SCHED	SCHEDULE
AFF	ABOVE FINISHED FLOOR	EXIST	EXISTING	MAS	MASONRY	SECT	SECTION
AGGR	AGGREGATE	EXP	EXPANSION	MATL	MATERIAL	SECY	SECRETARY
AIB	AIR INFILTRATION BARRIER	EXT	EXTERIOR	MAX	MAXIMUM	SF	SQUARE FEET
AL	ALUMINUM	EXTR	EXTRUDED	MB	MARKER BOARD	SFRM	SPRAYED FIRE-RESISTANT MATERIAL
ALT	ALTERNATE			MBR	MEMBER	SGL	SINGLE
AP	ACCESS PANEL	FA	FIRE ALARM	MDF	MEDIUM DENSITY FIBERBOARD	SH	SHELF
APC	ARCHITECTURAL PRECAST CONCRETE	FCU	FAN COIL UNIT	MECH	MECHANICAL	SHR	SHOWER
APPROX	APPROXIMATE	FD	FLOOR DRAIN	MEMB	MEMBRANE	SHT	SHEET(ING)
ARCH	ARCHITECT(URAL)	FDC	FIRE DEPARTMENT CONNECTION	MET	METAL	SHTNG	SHEATHING
AVB	AIR & VAPOR BARRIER	FDN	FOUNDATION	MEZZ	MEZZANINE	SIM	SIMILAR
		FE	FIRE EXTINGUISHER	MFR	MANUFACTURER	SK	SINK
BD	BOARD	FEC	FIRE EXTINGUISHER CABINET	MH	MANHOLE	SL	SEALANT
BG	BUMPER GUARD	FF	FINISH FLOOR	MIFRC	MASTIC INTUMESCENT FIRE RESISTIVE COATING	SMLS	SEAMLESS
BIT	BITUMINOUS	FGB	FIBERGLASS FACED SILICONE TREATED	MIN	MINIMUM	SP	SPACE(ING)
BKR	BACKER		GYPSUM CORE SHEATHING BOARD	MIR	MIRROR	SPEC	SPECIFICATION
BLDG	BUILDING	FGL	FIBERGLASS	MISC	MISCELLANEOUS	SPF	SPRAY FOAM
BLK	BLOCK	FH	FLATHEAD	MJ	MOVEMENT JOINT (IN MASONRY)	SPFI	SPRAY POLYURETHANE FOAM INSULATION
BLKG	BLOCKING	FIN	FINISH	MLDG	MOLDING	SPKR	SPEAKER
BLW	BELOW	FL	FLASHING	MLWK	MILLWORK	SPR	SPRINKLER
BM	BEAM, BENCHMARK	FLDG	FOLDING	MM	MILLIMETER	SQ	SQUARE
BOT	BOTTOM	FLR	FLOOR	MO	MASONRY OPENING	SR	SERVICE RECEPTOR
BR	BEDROOM	FLUOR	FLUORESCENT	MSCQ	METAL STUD CURTAIN WALL	SS	SERVICE SINK
BRCG	BRACING	FM	FLOOR MAT	MTD	MOUNTED	SST	STAINLESS STEEL
BRG	BEARING	FOC	FACE OF CONCRETE	MTG	MOUNTING	SSUR	SOLID SURFACING
BRK	BRICK	FOF	FACE OF FINISH	MULL	MULLION	STA	STATION
BRKT	BRACKET	FOM	FACE OF MASONRY	MW	MINERAL WOOL	STAGG	STAGGERED
BS	BOTH SIDES, BACKSPLASH	FOW	FACE OF WALL	MWF	MEMBRANE WALL FLASHING	STC	SOUND TRANSMISSION CLASS
BSMT	BASEMENT	FP	FROST PROOF			STD	STANDARD
BTWN	BETWEEN	FPRF	FIREPROOF(ED)(ING)	N	NORTH	STIFF	STIFFENER
		FR	FRAME	NA	NOT APPLICABLE	STL	STEEL
C/C	CENTER TO CENTER	FRT	FIRE RETARDANT TREATED	NF	NEAR FACE	STOR	STORAGE
CAB	CABINET	FS	FAR SIDE, FULL SIZE	NIC	NOT IN CONTRACT	STR	STRUCTURAL
CB	CATCH BASIN, CHALKBOARD, CONTROL BOX	FSFG	FIRE SAFING	NO	NUMBER	SUPP	SUPPORT
CBP	COMPOSITE BUILDING PANEL	FSP	FIRE STAND PIPE	NOM	NOMINAL	SURF	SURFACE
CEM	CEMENT	FT	FOOT, FEET	NRC	NOISE REDUCTION COEFFICIENT	SUSP	SUSPENDED
CFI	CONTRACTOR FURNISHED AND INSTALLED	FTG	FOOTING	NS	NEAR SIDE	SYM	SYMBOL, SYMMETRICAL
CFMF	COLD FORMED METAL FRAMING	FTR	FINNED TUBE RADIATION	NSF	NET SQUARE FEET	SYS	SYSTEM
CG	CORNER GUARD	FURN	FURNITURE	NTS	NOT TO SCALE		
CH	CEILING HEIGHT	FURR	FURRING			T	TREAD, FLUSH MOUNTED TELEPHONE
CI	CAST IRON	FUT	FUTURE	OA	OVERALL	T&G	TONGUE AND GROOVE
CIP	CAST IN PLACE CONCRETE	FWC	FABRIC WALL COVERING	OC	ON CENTER	TA	TOILET ACCESSORIES
CJ	CONTROL JOINT	FXTR	FIXTURE	OD	OUTSIDE DIAMETER	TB	TACKBOARD, TOWEL BAR
CL	CENTERLINE, CLOSET			OF	OUTSIDE FACE	TEL	TELEPHONE
CLG	CEILING	GA	GAUGE	OFCI	OWNER FURNISHED CONTRACTOR INSTALLED	TEMP	TEMPORARY, TEMPERED
CLR	CLEAR	GALV	GALVANIZED	OFF	OFFICE	TERR	TERRAZZO
CMPTR	COMPUTER	GC	GENERAL CONTRACTOR	OFOI	OWNER FURNISHED OWNER INSTALLED	THK	THICK(NESS)
CMU	CONCRETE MASONRY UNIT	GFRG	GLASS FIBER REINFORCED GYPSUM	OH	OPPOSITE HAND, OVERHEAD	TOB	TOP OF BEAM
COL	COLUMN	GGBFS	GROUND GRANULATED BLAST FURNACE SLAG	OPNG	OPENING	TOC	TOP OF CURB, CONCRETE
COMM	COMMUNICATION	GL	GLASS	OPP	OPPOSITE	TOP	TOP OF PEDESTAL
COMP	COMPRESSIBLE	GR	GRADE			TOS	TOP OF STEEL
CONC	CONCRETE	GRC	GLASS FIBER REINFORCED CONCRETE	PAR	PARALLEL	TOSL	TOP OF SLAB
CONF	CONFERENCE	GRL	GRILLE	PASS	PASSAGE, PASSENGER	TOW	TOP OF WALL
CONST	CONSTRUCTION	GRTG	GRATING	PB	PUSH BUTTON	TR	TOILET ROOM
CONST JT	CONSTRUCTION JOINT	GSF	GROSS SQUARE FEET	PBD	PARTICLE BOARD	TRANS	TRANSITION
CONT	CONTINUOUS	GSKT	GASKET	PC	PRECAST (STRUCTURAL)	TS	TUBE STEEL
CONTR	CONTRACTOR	GWB	GYPSUM WALLBOARD	PED	PEDESTAL	TV	TELEVISION
CONV	CONVECTOR	GYP	GYPSUM	PER	PERIMETER	TYP	TYPICAL
COORD	COORDINATE			PERP	PERPENDICULAR		
CORR	CORRIDOR, CORRUGATED	H	HIGH	PF	PREFABRICATED PANEL	UC	UNDERCOUNTER
CPT	CARPET	HC	HANDICAPPED	PGBD	PEGBOARD	UH	UNIT HEATER
CR	CRASH RAIL	HCT	HANDICAPPED ACCESSIBLE TOILET	PL	PLATE, PROPERTY LINE	UNEX	UNEXCAVATED
CRS	COURSE	HD	HEAD	PLAM	PLASTIC LAMINATE	UNFIN	UNFINISHED
CS	CAST STONE	HDBD	HARDBOARD	PLAS	PLASTIC	UNO	UNLESS NOTED OTHERWISE
CSK	COUNTERSUNK	HDW	HARDWARE	PLAT	PLATFORM	UR	URINAL
CSWK	CASEWORK	HDWD	HARDWOOD	PLBG	PLUMBING	UTIL	UTILITY
CT	CERAMIC TILE	HFS	HALF FULL SIZE	PLK	PLANK		
CTR	CENTER	HGT	HEIGHT	PLWD	PLYWOOD	VAR	VARIES
CTS	COUNTERTOP SINK	HM	HOLLOW METAL	PNEU	PNEUMATIC	VB	VAPOR BARRIER
CUB	CUBICLE	HORIZ	HORIZONTAL	PNL	PANEL	VCT	VINYL COMPOSITION TILE
CUH	CABINET UNIT HEATER	HP	HIGH POINT, HIGH PRESSURE, HORSE POWER	PNT	PAINT	VEN	VENEER
				PR	PAIR	VERT	VERTICAL
D	DEPTH	HR	HOUR, HANDRAIL	PREFAB	PREFABRICATED	VEST	VESTIBULE
DBL	DOUBLE	HVAC	HEATING, VENTILATION, AIR CONDITIONING	PRELIM	PRELIMINARY	VIF	VERIFY IN FIELD
DEMO	DEMOLITION			PSF	POUNDS PER SQUARE FOOT	VIN	VINYL
DEPT	DEPARTMENT	ID	INSIDE DIAMETER	PSI	POUNDS PER SQUARE INCH	VOL	VOLUME
DET	DETAIL	IF	INSIDE FACE	PT	POINT, PRESSURE TREATED	VP	VENEER PLASTER
DF	DRINKING FOUNTAIN	IN	INCH		(FOR MOISTURE)	VT	VINYL TILE
DIA	DIAMETER	INCL	INCLUDING	PTD	PAINTED	VTR	VENT THRU ROOF
DIM	DIMENSION	INS	INSULATION	PTN	PARTITION	VWC	VINYL WALL COVERING
DISP	DISPENSER	INT	INTERIOR				
DMPF	DAMPPROOFING	INV	INVERT	QT	QUARRY TILE	W	WIDE, WOMEN'S
DN	DOWN					W/	WITH
DO	DITTO	JAN	JANITOR	R	RISER	W/O	WITHOUT
DR	DOOR	JB	JUNCTION BOX	RAD	RADIUS	WC	WATER CLOSET, WHEELCHAIR
DS	DOWNSPOUT	JCT	JUNCTION	RAF	RAISED ACCESS FLOOR	WD	WOOD
DW	DISHWASHER	JST	JOIST	RBR	RUBBER	WF	WIDE FLANGE
DWG	DRAWING	JT	JOINT	RCP	REFLECTED CEILING PLAN	WIN	WINDOW
DWL	DOWEL			RD	ROOF DRAIN	WM	WALK OFF MAT
DWR	DRAWER	K	KIP	REC	RECESSED	WP	WORKING POINT, WATERPROOF(ING),
DWTR	DUMBWAITER	KIT	KITCHEN	RECPT	RECEPTACLE		WALL PROTECTION
		KO	KNOCK OUT	RECT	RECTANGULAR	WR	WATER RESISTANT, WASTE RECEPTOR
EA	EACH	KPL	KICK PLATE	REF	REFERENCE	WS	WATER STOP
EB	EXPANSION BOLT			REFR	REFRIGERATION	WSCT	WAINSCOT
				REG	REGISTER	WT	WEIGHT, WINDOW TREATMENT

SYMBOL LEGEND

BRICK

CONCRETE

CONCRETE MASONRY UNIT

CRUSHED STONE

EARTH

GYPSUM WALL BOARD

INSULATION (BATT)

INSULATION (RIGID)

METAL (ALUMINUM)

METAL (STEEL, IRON)

PLYWOOD

WOOD FINISH

WOOD FRAMING & BLOCKING

PROJECT AREA LINE

THIS LINE GENERALLY INDICATES THE AREA WHERE THE WORK OF THIS PROJECT OCCURS; SOME INCIDENTAL WORK MAY OCCUR OUTSIDE THIS LINE.

PROPERTY LINE

COLUMN REFERENCE GRID

SLOPE UP

SLOPE DOWN

KEYPLAN COMBINATION NORTH ARROW

KEYPLAN COMBINATION NORTH ARROW

FLOOR ELEVATION
EL 20'-0"

EXIST WALLS, DOORS (SCREENED)

DEMOLITION WALLS, DOORS (DASHED)

NEW WALLS, DOORS (SOLID)

DOOR TAG

6" UNLESS NOTED OTHERWISE

ROOM NAME AND NUMBER

PARTITION TYPE, SEE A4.1

ELEVATION REFERENCES (ARROW INDICATES DIRECTION OF VIEW)

EXTERIOR ELEVATION NUMBER A3.2

(SHEET NUMBER NOT REQUIRED IF DETAIL ELEVATION IS ON SAME SHEET)

INTERIOR ELEVATION NUMBER

(DETAIL ELEVATION ON SAME SHEET)

MULTIPLE ELEVATION NUMBER A5.1.1

(SHEET NUMBER NOT REQUIRED IF DETAIL ELEVATION IS ON SAME SHEET)

DETAIL NUMBER
SHEET NUMBER A3.3.2
NOTE

SECTION/DETAIL REFERENCES (ARROW INDICATES DIRECTION OF VIEW)

BUILDING SECTION NUMBER
SHEET NUMBER A3.3.15
NOTE

WALL SECTION NUMBER
SHEET NUMBER A3.3.15
NOTE

PLAN/SECTION DETAIL NUMBER
SHEET NUMBER A3.3.15
NOTE

DETAIL PLAN/ELEVATION (BOX INDICATES AREA OF VIEW)

DETAIL NUMBER
SHEET NUMBER

DIMENSION TO FACE

DIMENSION TO CENTERLINE
(TYP DIM. TO CENTERLINE OF PTN)

DIMENSION CONTINUES

LIMIT OF WORK

AREA OF REVISION

REVISION

DEMOLITION AND/OR ALTERATION NOTE

WORK POINT, CONTROL POINT, OR DATUM POINT

CASEWORK UTILITY (INDIVIDUAL)

CASEWORK UTILITY (GROUP)

LOUVER TYPE

WINDOW TYPE

ACCESS PANEL

ELECTRIC PANEL

FIRE EXTINGUISHER CABINET

CARD READER

ACTUATOR (POWER OPERATOR)

PUSH BUTTON (RELEASE)

SENSORS (DOOR CONTROL)

GENERAL NOTES

1. ELEVATION DATUM OF 0.00' CORRESPONDS TO THE CIVIL DATUM OF 56.75'

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6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

ABBREVIATIONS & SYMBOL LIST

PHASE CD

DRAWING NO. G.1

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APPLICABLE CODES & STANDARDS:

- ***2015 International Building Code***
- ***2018 NFPA 101 Life Safety Code***
- ***2017 ICC /ANSI A117.1 Accessible and Usable Buildings and Facilities***
- ***2010 ADA Standard for Accessible Design***
- ***COMAR 9.12.53 Maryland Accessibility Code***
- ***2019 State of Maryland Fire Prevention Code***
- ***2015 IECC International Energy Conservation Code***
- ***2015 International Existing Building Code***
- ***2015 International Plumbing Code***
- ***2015 International Mechanical Code***
- ***2019 NFPA 72 National Fire Alarm and Signaling Code***
- ***2019 NFPA 13 Installation of Sprinkler Systems***
- ***2020 NFPA 70 National Electrical Code***
- ***2015 International Fuel Gas Code***

PROJECT NARRATIVE:

Home and Visitor Clubhouse renovation and expansion improvements including upgraded finishes, reconfiguration of existing spaces and minor expansion within the existing stadium. An existing batting tunnel will be shifted at the Visitor Clubhouse and a batting tunnel addition will connect to the Home Clubhouse. Total area of addition / renovation is 26,448 sf.

ITEM No.	ITEM	*The International Building Code (IBC) 2018* SECTION	REQUIREMENT	COMPLIANCE
1.0	**Occupancies:**			
	Primary Occupancies:	302.1	Structure shall be classified per occupancy group:	A-5
				Accessory Groups A-3, B, S
2.0	**Construction Type & General Building...**			
	Construction Type	602.1	Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types	IIB
	Height Limitations & Modifications	504.3	The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3. [Based on most restrictive occupancy]	
	Allowable Height	Table 504.3	A Type: IIB: 75'	58'-7"
	Allowable Stories	Table 504.4	A-5 | Type: IIB: 3 Stories	3 Stories
	Area Limitations & Modifications	506.1	The floor area of a building shall be determined based on the type of construction, occupancy classification, whether there is an automatic sprinkler system installed throughout the building and the amount of building frontage on public way or open space	
	Allowable Area	Table 506.2	A-5 Type: IIB: Unlimited	Area of Work: 26,448 SF
3.0	**Structural Fire Resistance Ratings**			
	Primary Struct. Frame	Table 601	Type: IIB - 0 hrs.	0 hrs.
	Bearing Walls			
	Exterior	Table 601	Type: IIB - 0 hrs.	0 hrs.
	Interior	Table 601	Type: IIB - 0 hrs.	0 hrs.
	Non Bearing Walls Exterior	Table 602	Type: ALL | Groups A,B FSD greater than 30' = 0 hrs	0 hrs. all FSD greater than 30'
	Floor and Secondary Members	Table 601	Type: IIB - 0 hrs.	0 hrs.
	Roof and Secondary Members	Table 601	Type: IIB - 0 hrs.	0 hrs.
4.0	**Fire Resistance - Interior Partition**			
	Incidental Uses			
	Laundry Rooms over 100 SF	Table 509	1 hour or provide automatic sprinkler system	Fully Sprinklered
5.0	**Means of Egress:**			
	Occupant Load (SF/ Occupant):			
	Offices	1004.5 | 1004.8	100 gross | 50 gross (concentrated)	Refer to Life Safety Plans
	Exercise Rooms	1004.5	50 gross	Refer to Life Safety Plans
	Locker Room	1004.5	50 gross	Refer to Life Safety Plans
	Assembly: Unconcentrated . (Dining)	1004.5	15 net	Refer to Life Safety Plans
	Assembly: Concentrated (Chairs only - not fixed)	1004.5	7 net	Refer to Life Safety Plans
	Accessory Storage/ Equipment	1004.5	300 gross	Refer to Life Safety Plans
	Egress Components:			
	Ceiling Height	1003.2	7'-6" min.	8'-0" min.
	Protruding Objects			
	Headroom	1003.3.1	80" min. headroom, or barrier to be provided	New Objects to be Compliant
	Free-standing Objects	1003.3.2	4" max. overhang greater than 27" AFF	New Objects to be Compliant
	Horizontal Projections	1003.3.3	4" max. overhang between 27"-80" AFF	New Objects to be Compliant
	Doors	1010.1		
	Size	1010.1.1	The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 32 inches	36" Minimum Doors
	Landings	1010.1.6	Landings shall have a width not less than the width of the stairway or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches	Compliant - Refer to Plans
	Thresholds	1010.1.7	Thresholds at doorways shall not exceed 3/4 inch in height above the finished floor or landing for sliding doors serving dwelling units or 1/2 inch above the finished floor or landing for other doors. Raised thresholds and floor level changes greater than 1/4 inch at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-per-cent slope).	Compliant
	Arrangement	1010.1.8	Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.	Compliant - Refer to Plans
	Door Encroachment	1005.7	Doors, when fully opened, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half	Compliant - Refer to Plans
	Corridors	1020		
	Construction	1020.1	Sprinklered Group(s): A, B & S: 0 hrs.	Sprinklered Building; 0 hrs.
	Width	1020.2	44" Minimum	44" Minimum
	Dead Ends	1020.4	Group: A: 20' Sprinklered Group(s): B & S: 50'	Compliant - Refer to Plans
	Exit Access			
	Common Path of Travel	1006.2.1	All spaces sprinklered A: 75' B: 100' S: 100'	Compliant - Refer to Life Safety Plans
	Exit and Exit Access Doorways			
	Exit Access Travel Distance	1017.2	All spaces sprinklered A: 250' B: 300' S: 250'	Compliant - Refer to Life Safety Plans
	No. of Exits and Continuity			
	Minimum No. for Occupant Load	1006.3.2		
	1-500	1006.3.2	2	Compliant - Refer to Plans
	501-1000	1006.3.2	3	Compliant - Refer to Plans
	More than 1000	1006.3.2	4	Compliant - Refer to Plans
6.0	**Accessibility**			
	Compliance	1102.1	Buildings and facilities shall be designed and constructed to be accessible in accordance with this code and ICC A117.1.	Compliant - Refer to Plans
	Accessible Route	1104.2	At least one accessible route shall connect accessible buildings, accessible facilities, accessible elements and accessible spaces that are on the same site.	Compliant: All routes are accessible
		1104.3.1	Employee work areas. Common use circulation paths within employee work areas shall be accessible routes.	Compliant: All routes are accessible
7.0	**Interior Finishes**			
	Wall and Ceiling Finishes			
	Exit Access Corridors & Other . Exitways	803.13	All spaces sprinklered A : Class B B : Class C S : Class C	New Finishes to Comply
	Rooms and Enclosed Spaces	803.13	All spaces sprinklered A : Class C B : Class C S : Class C	New Finishes to Comply
	Floor Finishes	804.2	Interior floor finish and floor covering materials required by Section 804.4.2 to be of Class I or II materials shall be classified in accordance with ASTM E648 or NFPA 253. The classification referred to herein corresponds to the classifications determined by ASTM E648 or NFPA 253 as follows: Class I, 0.45 watts/cm 2 or greater; Class II, 0.22 watts/cm2 or greater.	New Finishes to Comply
8.0	**Fire Protection Systems**			
	Fire Alarm and Detection Systems	907.2.1	A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more	A manual, automatic fire alarm system shall be provided for the building
			Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.	
	Automatic Sprinkler Systems	903.2.1.5.1	Spaces under grandstands or bleachers. Enclosed spaces under grandstands or bleachers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where the enclosed area exceeds 1,000 square feet	The building shall be equipped with an automatic s[spinkler system, and will be fully sprinklered

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EWING COLE

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EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE

DRAWING NAME

CODE STUDY

PHASE CD

DRAWING NO. G.2

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LS - EXISTING EXIT ELEMENTS - HOME CLUBHOUSE FIELD					
EXIT #	DOOR CLEAR WIDTH (IN)	DOOR CAPACITY (OCCUPANTS)	LIMITING CAPACITY (OCCUPANTS)	OCCUPANTS USING EXIT	SPARE EXIT CAPACITY
CLUBHOUSE & BATTING ARENA					
EXIT #8	68 1/2"	342	342	30	312
EXIT #9	68 1/2"	342	342	30	312
Grand total			684	60	624

LS - EXISTING EXIT ELEMENTS - HOME CLUBHOUSE					
EXIT #	DOOR CLEAR WIDTH (IN)	DOOR CAPACITY (OCCUPANTS)	LIMITING CAPACITY (OCCUPANTS)	OCCUPANTS USING EXIT	SPARE EXIT CAPACITY
CLUBHOUSE & BATTING ARENA					
EXIT #1	68 1/2"	342	342	34	308
EXIT #2	34 1/4"	171	171	25	146
EXIT #3	34 1/4"	171	171	25	146
EXIT #4	34 1/4"	171	171	25	146
EXIT #5	68 1/2"	342	342	2	340
EXIT #6	68 1/2"	342	342	2	340
EXIT #7	34 1/4"	171	171	1	170
Grand total			1710	114	1596

EXTERIOR - PARKING LOT

EXTERIOR - PLAYING FIELD

2 HOME CLUBHOUSE LIFE SAFTEY PLAN
SCALE: 1/8" = 1'-0"

PN TN

LIFE SAFETY PLAN NOTES

1. REFER TO SHEET G.2 FOR DETAILED EGRESS, ACCESSIBILITY, AND CODE SUMMARY.

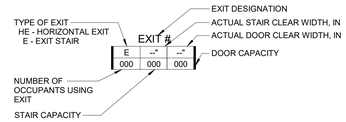
2. THE PROVIDED SHEET NOTES AND GRAPHIC TRAVEL DISTANCE DEPICTIONS ARE NOTE ALL INCLUSIVE AND ARE TO BE USED AS A GUIDE IN DETERMINING CODE COMPLIANCE. DRAWING NOTES ARE PROVIDED FOR ITEMS THAT ARE AN EXCEPTION OR MAY NOT APPEAR CLEAR WITHIN PLANS.

SPACE FUNCTION LEGEND

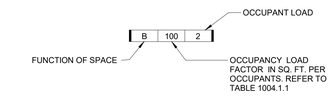
- ASSEMBLY - GROUP A-2
- ASSEMBLY - GROUP A-3
- BUSINESS - GROUP B
- CORRIDOR
- EXERCISE ROOMS
- INCIDENTAL UESES
- STORAGE
- UNOCCUPIED
- NOT IN SCOPE

LIFE SAFETY LEGEND

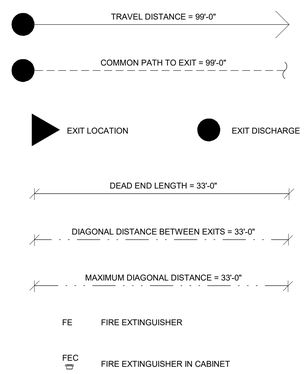
EXIT STAIR SYMBOL:



OCCUPANCY LOAD SYMBOL:



ADDITIONAL LIFE SAFETY SYMBOLS:



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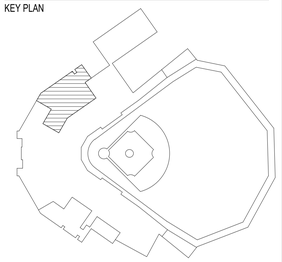

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6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

HOME CLUBHOUSE LIFE SAFTEY PLAN

PHASE CD

DRAWING NO. LS2.1

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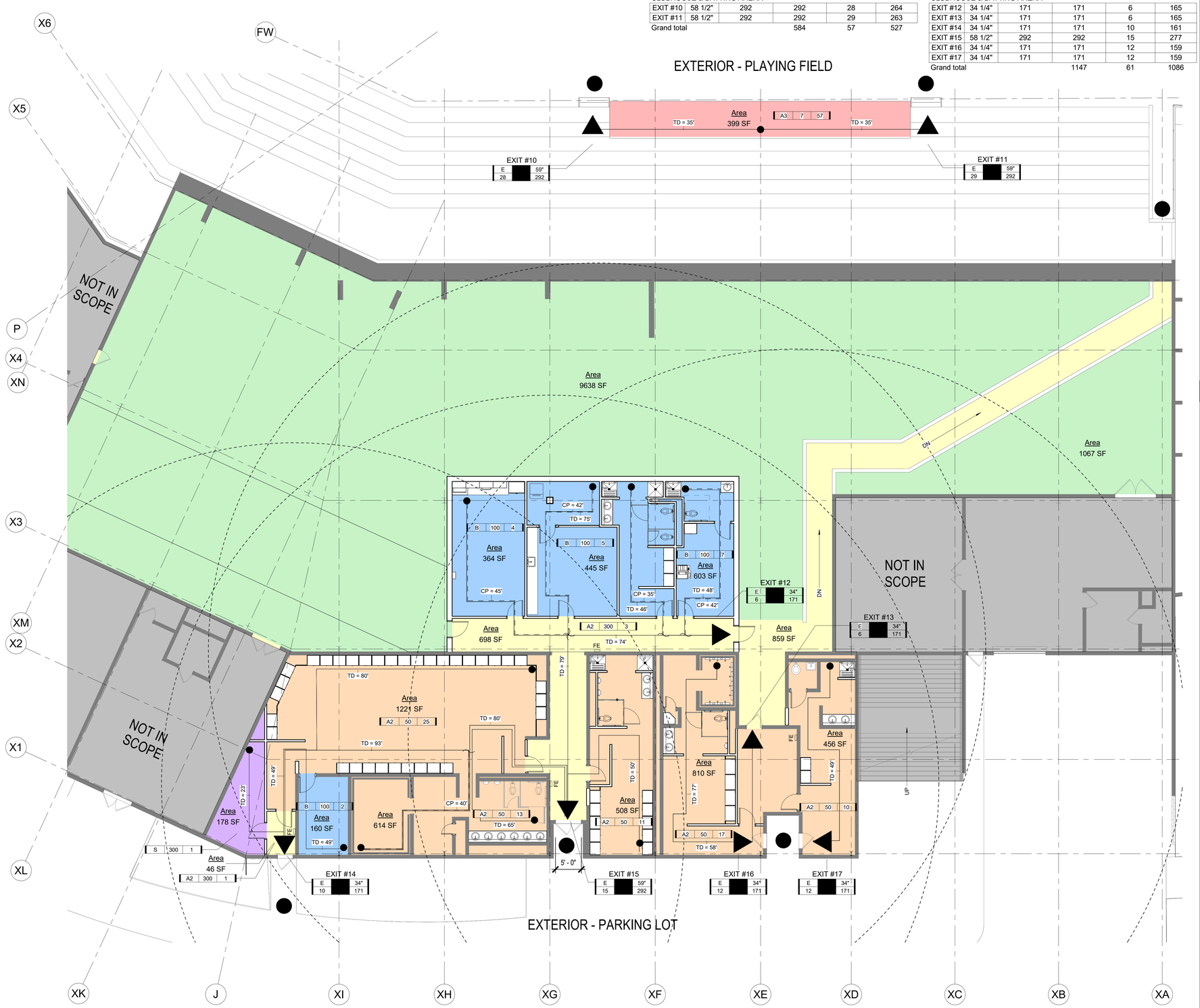
LS - EXISTING EXIT ELEMENTS - VISITOR CLUBHOUSE FIELD					
EXIT #	DOOR CLEAR WIDTH (IN)	DOOR CAPACITY (OCCUPANTS)	LIMITING CAPACITY (OCCUPANTS)	OCCUPANTS USING EXIT	SPARE EXIT CAPACITY
CLUBHOUSE & BATTING ARENA					
EXIT #10	58 1/2"	292	292	28	264
EXIT #11	58 1/2"	292	292	29	263
Grand total			584	57	527

LS - EXISTING EXIT ELEMENTS - VISITOR CLUBHOUSE					
EXIT #	DOOR CLEAR WIDTH (IN)	DOOR CAPACITY (OCCUPANTS)	LIMITING CAPACITY (OCCUPANTS)	OCCUPANTS USING EXIT	SPARE EXIT CAPACITY
CLUBHOUSE & BATTING ARENA					
EXIT #12	34 1/4"	171	171	6	165
EXIT #13	34 1/4"	171	171	6	165
EXIT #14	34 1/4"	171	171	10	161
EXIT #15	58 1/2"	292	292	15	277
EXIT #16	34 1/4"	171	171	12	159
EXIT #17	34 1/4"	171	171	12	159
Grand total			1147	61	1086



2 VISITOR CLUBHOUSE LIFE SAFTEY PLAN
SCALE: 1/8" = 1'-0"

PN TN

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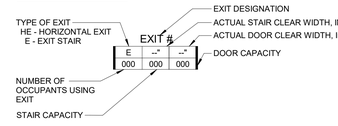

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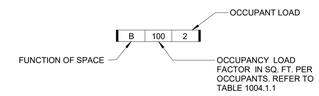
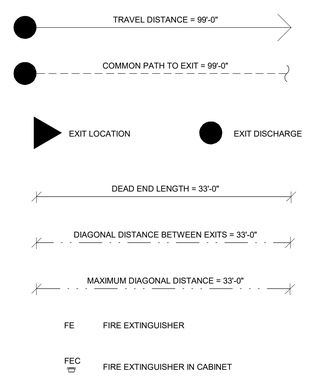


ADDITIONAL LIFE SAFETY SYMBOLS:



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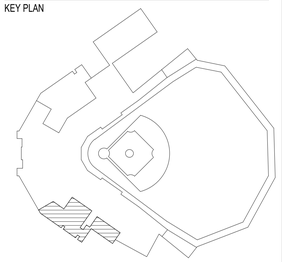

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DRAWING NAME

VISITOR CLUBHOUSE LIFE SAFTEY PLAN

PHASE CD
DRAWING NO. LS2.2

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DELMARVA SHOREBIRDS

ARTHUR W. PERDUE STADIUM

WICOMICO COUNTY, MARYLAND SITE PLAN

SITE DATA:

1. OWNER / DEVELOPER:
   WICOMICO COUNTY MARYLAND
   GOVERNMENT OFFICE BUILDING
   SALISBURY, MD 21801
   CONTACT: CHRIS BITTERS
   EMAIL: CBITTERS@THE SHOREBIRDS.COM
   PH: 410-219-3112

2. ENGINEER/SURVEYOR
   McCRONE
   119 NAYLOR MILL ROAD, SUITE 3
   SALISBURY, MD 21801
   CONTACT: RYAN CONWAY, P.E.
   EMAIL: RCONWAY@MCCRONE-ENGINEERING.COM
   PH: (410) 548-1492

3. ZONING INFORMATION:

TAX MAP:	MAP 39, PARCEL 618, LOT PAR 2		
DEED REF:	1445/122		
PLAT REF:	SHA/61966		
ZONING:	C-3 REGIONAL COMMERCIAL		
LOT REQUIREMENTS:			
SETBACKS:	REQUIRED:	EXISTING:	PROPOSED:
FRONT	100 FT./125 FT.*	100 FT.	345.8' (BATTING FACILITY)
SIDE	25 FT./40 FT.**	25 FT.	943.2' (L) / 321.8' (R) (BATTING FACILITY)
REAR	30 FT./50 FT.***	30 FT	106.2' (BATTING FACILITY)
LOT AREA:	40,000 SQ. FT.	1,652,666 SQ. FT.	N/A
LOT WIDTH:	200 FT.	1,335 FT.	N/A
LOT FRONTAGE:	200 FT.	1,886.16 FT.	N/A
MAX. LOT COVERAGE:	35%****	5.7%	6.5%
MAX. BLDG HEIGHT:	50 FT.	VARIES	±37' (BATTING FACILITY - REFER TO ARCHITECTURAL PLANS)

* MEASURED FROM THE PROPERTY LINE / MEASURED FROM THE CENTER LINE OF THE ROAD. THE GREATER OF THE TWO SHALL APPLY
** THE GREATER SIDE SETBACK REQUIREMENT SHALL BE REQUIRED ADJACENT TO RESIDENTIAL DISTRICT.
*** THE GREATER REAR SETBACK REQUIREMENT SHALL BE REQUIRED ADJACENT TO RESIDENTIAL DISTRICT.
**** PER WICOMICO COUNTY ZONING ADMINISTRATOR, CLARK MEADOWS. LOT COVERAGE REFERS TO BUILDING FOOTPRINT.

4. SITE INFORMATION:
   6400 HOBBS ROAD
   SALISBURY, MD 21804

SITE AREA:	±37.94 ACRES
TOTAL DISTURBED AREA:	±1.18 ACRES
EXISTING LOT COVERAGE:	±16.27 ACRES
PROPOSED LOT COVERAGE:	±0.22 ACRES
TOTAL LOT COVERAGE:	±16.49 ACRES
PROPOSED BLDG HEIGHT:	± 37' - REFER TO ARCHITECTURAL PLANS
PROPOSED AREAS:	±12,145 SQ. FT.

5. FLOOD ZONE
   PROPERTY IS LOCATED IN FLOOD ZONE X OTHER AREAS: AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN PER FIRM COMMUNITY PANEL NUMBERS 24045C0260E & 24045C0256E. EFFECTIVE DATE IS AUGUST 17, 2015.

6. DATUM
   VERTICAL DATUM IS NAVD 88.
   HORIZONTAL DATUM IS NAD 83

7. RESOURCE PROTECTION
   TIDAL & NON-TIDAL WETLANDS ARE NOT PRESENT IN THE PROJECT AREAS.

8. BOUNDARY AND TOPOGRAPHIC SURVEY
   PARTIAL BOUNDARY AND PARTIAL TOPOGRAPHIC SURVEY WAS PERFORMED BY McCRONE IN FEBRUARY 2024.

9. PARKING
   THE EXISTING PARKING LOT IS PROPOSED TO BE REPAVED AND RESTRIPED. A SECTION OF THE PARKING LOT WILL BE ENCLOSED IN A FENCE FOR PLAYER AND STAFF PARKING ONLY.
   FENCED PARKING AREA:
   EXISTING:
   STANDARD SPACES 27 - 9' X 19'
   TOTAL 27 - 9' X 19'
   PROPOSED:
   STANDARD SPACES 24 - 9' X 19'
   HANDICAP SPACES 2 - 8' X 19' (INCLUDES 1 - 8' X 19' VAN ACCESSIBLE SPACE)
   TOTAL 26 SPACES

   STADIUM:
   EXISTING: 1104 SPACES
   PROPOSED: 1103 SPACES

10. FOREST CONSERVATION
    EXISTING FOREST CONSERVATION PLAN #94-39.

11. WATER AND SEWER
    ONSITE WATER AND SEWER ARE PROVIDED BY THE CITY OF SALISBURY THROUGH SERVICE CONNECTIONS TO AN EXISTING 16" WATER MAIN & 18" SEWER MAIN WITHIN THE PARKING LOT. THESE EXISTING 16" & 18" MAINS WILL NOT BE AFFECTED. NO NEW WATER & SEWER CONNECTIONS ARE PROPOSED.

12. SITE LIGHTING
    THE EXISTING PARKING LOT LIGHTS AND POLES ARE TO BE REPLACED. PROPOSED TRENCHING THROUGH THE EXISTING PARKING LOT IS SHOWN FOR THE NEW ELECTRICAL LINES.

13. SITE SIGNAGE
    NO NEW SITE SIGNAGE IS PROPOSED.

14. APPROVALS NEEDED
    A. MARYLAND DEPARTMENT OF THE ENVIRONMENT.
    - NOTICE OF INTENT
    - ENVIRONMENTAL SITE DESIGN PLAN
    - EROSION AND SEDIMENT CONTROL PLAN

15. ENVIRONMENTAL
    PORTION OF THE SITE IS LOCATED WITHIN A WELLHEAD PROTECTION AREA PER WICOMICO COUNTY PALEOCHANNEL & WELLHEAD PROTECTIONS AREAS MAP.

LEGEND

	EXISTING	PROPOSED
PROPERTY LINE		N/A
EASEMENT LINE		
EASEMENT HATCH		
R.O.W. LINE		N/A
IRON ROD FOUND/SET	IRF	IRS
CAPPED PIN FOUND/SET	CPF	CPS
CONCRETE MONUMENT FOUND/SET	CMF	CMS
IRON PIPE FOUND/SET	IPF	IPS
BENCH MARK	ELEV: 100.00	N/A
SPOT ELEV. LABEL	100.01	100.01
BUILDING		
MAJOR CONTOUR	25	25
MINOR CONTOUR	24	24
ROAD CENTERLINE		
CURB		N/A
EDGE OF DIRT ROAD		N/A
PAVEMENT HATCH		N/A
GRAVEL		
SIDEWALK/CONCRETE		
FENCE LINE	X	N/A
OVERHEAD ELECTRIC	E	N/A
UNDERGROUND ELEC, CATV	E	E

	EXISTING	PROPOSED
UNDERGROUND TELE, CATV	TC	N/A
SOILS LINE		N/A
INLET		
STORM PIPE	SD	ST
RIP RAP		
SANITARY MANHOLE	S	N/A
SANITARY CLEANOUT	C/O	N/A
SANITARY PIPE	SS	N/A
FORCE MAIN	FM	N/A
GAS MAIN	G	G
WATER VALVE	WV	
WATER METER	N/A	M
WATER PIPE	W	N/A
FIRE HYDRANT		N/A
WOODS LINE		N/A
TREE/SHRUB		N/A
UTILITY POLE & GUY WIRE		N/A
STADIUM LIGHT POLE		N/A
LIGHT POLE		N/A
STORM MANHOLE	N/A	
SIGN		N/A
SILT FENCE	N/A	SF
SUPER SILT FENCE/ SMART FENCE 42	N/A	SSF
STABILIZED CONSTRUCTION ENTRANCE	N/A	SCE
LIMITS OF DISTURBANCE	N/A	LOD

VICINITY MAP
SCALE: 1"=2000'±

LOCATION MAP
NOT TO SCALE

Sheet List Table

Sheet Number	Sheet Title
C1	COVER SHEET
C2	OVERALL EXISTING CONDITIONS PLAN
C3	EXISTING CONDITIONS PLAN
C4	EXISTING CONDITIONS PLAN
C5	EXISTING CONDITIONS PLAN
C6	DEMOLITION PLAN
C7	DEMOLITION PLAN
C8	OVERALL SITE PLAN
C9	SITE PLAN
C10	SITE PLAN
C11	SITE DETAILS
C12	GRADING PLAN
C13	GRADING PLAN
C14	STORMWATER MANAGEMENT PLAN
C15	STORMWATER MANAGEMENT DETAILS
C16	EROSION & SEDIMENT CONTROL PLAN
C17	EROSION & SEDIMENT CONTROL PLAN
C18	EROSION & SEDIMENT CONTROL DETAILS
C19	EROSION & SEDIMENT CONTROL DETAILS
C20	EROSION & SEDIMENT CONTROL DETAILS

IMPERVIOUS AREA BREAKDOWN WITHIN THE LIMIT OF DISTURBANCE

DESCRIPTION	AREA
FIRST BASE SIDE:	
EXISTING CONCRETE WATER TOWER BASE (TBR)	137 SF
EXISTING CONCRETE AREAS (TBR)	14,182 SF
PROPOSED BATTING FACILITY	9,317 SF
PROPOSED TURF AREA	1,019 SF
PROPOSED CONCRETE AREAS	10,368 SF
PROPOSED PRE-ENGINEERED METAL CANOPIES	1,414 SF
THIRD BASE SIDE:	
EXISTING CONCRETE WALKWAY (TBR)	857 SF
EXISTING CONCRETE WALKWAY (TR)	235 SF
PROPOSED CONCRETE WALKWAY	1,025 SF
PROPOSED PRE-ENGINEERED METAL CANOPIES	1,414 SF

PROPERTY OWNER DATA LEGEND

A. HOBBS ROAD DEVELOPMENT LLC; TAP MAP: 39 PARCEL: 618 DEED REF: 2753/175
B. HOBBS ROAD DEVELOPMENT LLC; TAP MAP: 39 PARCEL: 618 DEED REF: 2753/175
C. HOBBS ROAD DEVELOPMENT LLC; TAP MAP: 39 PARCEL: 729 DEED REF: 2409/78
D. SEAGULL INVESTMENTS LLC; TAP MAP: 39 PARCEL: 6640 DEED REF: 4912/130
E. SALISBURY BAPTIST TEMPLE; TAX MAP: 39 PARCEL: 335 DEED REF: 1309/460
F. SALISBURY BAPTIST TEMPLE; TAX MAP: 39 PARCEL: 336 DEED REF: 883/513
G. RONALD K. & NACY C. BRIDGE; TAX MAP: 39 PARCEL: 337 DEED REF: 3913/471
H. SALISBURY SCHOOL INC; TAX MAP: 39 PARCEL: 648 DEED REF: 761/356
I. CERES FARMS II LLC; TAX MAP: 39 PARCEL: 156 DEED REF: 3838/79
J. SAMUEL T. & CHRISTINA W. PARKER; TAX MAP: 39 PARCEL: 231 DEED REF: 4551/230
K. RODNEY A. & CAROL A. WENRICH; TAX MAP: 39 PARCEL: 233 DEED REF: 964/483

GENERAL NOTES

1. THESE DRAWINGS SHOW INFORMATION OBTAINED FROM THE BEST AVAILABLE RECORDS REGARDING PIPES, CONDUITS, TELEPHONE LINES, AND OTHER STRUCTURES AND CONDITIONS WHICH EXIST ALONG THE LINES OF WORK AT AND BELOW THE SURFACE OF THE GROUND. THE OWNER AND ENGINEER DISCLAIM ANY RESPONSIBILITIES FOR THE ACCURACY OR COMPLETENESS OF SAID INFORMATION BEING SHOWN ONLY FOR THE CONVENIENCE OF THE CONTRACTOR WHO MUST VERIFY THE INFORMATION TO HIS OWN SATISFACTION. IF THE CONTRACTOR RELIES ON SAID INFORMATION, HE DOES SO AT HIS OWN RISK. THE GIVING OF THE INFORMATION ON THE CONTRACT DRAWINGS WILL NOT RELIEVE THE CONTRACTOR OF HIS OBLIGATIONS TO SUPPORT AND PROTECT ALL PIPES, CONDUITS, TELEPHONE LINES AND OTHER STRUCTURES.
2. ALL MATERIALS AND METHODS OF CONSTRUCTION SHALL CONFORM TO THE DRAWINGS, SPECIFICATIONS, THE LOCAL BUILDING CODES AND WICOMICO COUNTY CONSTRUCTION STANDARDS.
3. ALL DISTURBED AREAS SHALL BE SMOOTHLY GRADED TO PROMOTE POSITIVE DRAINAGE AND STABILIZED WITH SOD OR TOPSOIL, SEED AND MULCH. IF SETTLEMENT OCCURS, TOPSOIL, SEEDING AND MULCH SHALL BE REPEATED UNTIL SETTLEMENT SUBSIDES. (SEE EROSION AND SEDIMENT CONTROL DETAILS AND SPECIFICATIONS.)
4. THE CONTRACTOR SHALL NOTIFY THE FOLLOWING TWO (2) WEEKS PRIOR TO THE START OF CONSTRUCTION AND SHALL COORDINATE ALL CONSTRUCTION PHASES WITH THEM:
   McCRONE 410-548-1492
   OWNER 410-219-3112
   MDE 410-537-3000
5. CONTACT THE MDE SEDIMENT CONTROL INSPECTOR (410)-901-4020 AND THE WICOMICO COUNTY DEPARTMENT OF PUBLIC WORKS CONSTRUCTION INSPECTOR STAFF AT (410)-548-4810 TO CONDUCT A PRE-CONSTRUCTION MEETING ONSITE AT LEAST 2 WEEKS PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES. FAILURE TO CONDUCT THE REQUIRED PRE-CONSTRUCTION MEETING WITH DEPARTMENT OF PUBLIC WORKS INSPECTOR PRESENT MAY EXPOSE THE OWNER/DEVELOPER AND/OR CONTRACTOR TO ADDITIONAL WORK AND/OR FINES AND PENALTIES.
6. ALL CONSTRUCTION SHALL BE MARKED FOR PEDESTRIAN AND VEHICULAR TRAFFIC.
7. SHOULD ANY DAMAGE OCCUR TO EXISTING UTILITIES, IT SHALL BE REPAIRED SOLELY AT THE CONTRACTOR'S EXPENSE.
8. CONTRACTOR SHALL CONTACT CONNECTIVE POWER DELIVERY AT 1-800-375-7117 PRIOR TO COMMENCING WITHIN THE PROXIMITY OF THE UNDERGROUND POWER LINES.
9. ALL DRAINAGE STRUCTURES AND TRENCHES SHALL REMAIN FUNCTIONAL DURING CONSTRUCTION.
10. THE OWNER IS RESPONSIBLE FOR THE ACQUISITION OF ALL EASEMENTS, BOTH TEMPORARY AND PERMANENT.
11. ALL WATER VALVES, BOXES AND HYDRANTS SHALL BE SET AND ADJUSTED TO FINISHED GRADE.
12. TRENCHES SHALL NOT REMAIN OPEN OVERNIGHT. IF IT IS NECESSARY FOR TRENCHES TO REMAIN OPEN, STEEL PLATES CAPABLE OF BEARING TRAFFIC SHALL BE USED TO COMPLETELY COVER THE TRENCH OPENINGS.
13. STORM DRAIN PIPES SHALL HAVE WATER TIGHT CONNECTIONS AND A RUBBER GASKET SHALL BE PROVIDED ON THE PIPE OR INLET AT PIPE TO INLET CONNECTIONS. A CAMERA TEST AFTER INSTALLATION SHALL BE PROVIDED TO VERIFY CORRECT INSTALLATION (ALIGNMENT, GRADE, DEFORMATION, AND JOINTS.)
14. THE CONTRACTOR ASSUMES ALL RESPONSIBILITY FOR ANY DEVIATION FROM THESE PLANS.
15. ANY PROPERTY LINE MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE REPLACED SOLELY AT THE CONTRACTOR'S EXPENSE.
16. THE CONTRACTOR SHOULD HAVE UTILITIES LOCATED PRIOR TO DIGGING.
17. THE CONTRACTOR SHALL VERIFY EXISTING INVERTS PRIOR TO CONSTRUCTION OF UNDERGROUND UTILITIES. TEST PITTING OF EXISTING LINES PRIOR TO CONSTRUCTION, IF NECESSARY, SHALL BE COORDINATED WITH THE OWNER.
18. ALL EXISTING UTILITIES SHALL REMAIN UNLESS OTHERWISE NOTED.
19. THE CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL SURVEY CONTROL PRIOR TO STAKING OUT FOR CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
20. SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO COMMENCING LAND DISTURBING ACTIVITIES.
21. UTILITY LOCATIONS AND SURFACE PROFILES, MANHOLE, CLEANOUT TOP ELEVATIONS, ETC., AND CROSSING PIPE ELEVATIONS ARE APPROXIMATE. REFER TO GRADING PLANS FOR GROUND SURFACE ELEVATIONS. INSTALL RIMS, LIDS, ETC. FLUSH WITH FINAL GRADE.
22. ALL DISTURBED AREAS SHALL BE STABILIZED IN ACCORDANCE WITH RECOMMENDATIONS SHOWN ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
23. ALL MATERIALS AND METHODS OF CONSTRUCTION SHALL BE IN STRICT CONFORMANCE WITH THE WICOMICO COUNTY, MARYLAND CONSTRUCTION STANDARDS ROADS, STREETS, AND INCIDENTAL STRUCTURES, THE MARYLAND STATE HIGHWAY ADMINISTRATION BOOK OF STANDARDS FOR HIGHWAY & INCIDENTAL STRUCTURES. WHERE THESE SPECIFICATIONS CONFLICT, THE MOST ROBUST SPECIFICATION SHALL BE FOLLOWED.
24. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF ALL EXISTING UTILITIES AND ROADS PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER WITH PROPOSED MODIFICATIONS NEEDED. CORRECTIONS OF ALL DISCREPANCIES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
25. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROTECT ALL INSTALLED PIPING UNTIL COMPLETION OF THE PROJECT. PIPES WITH SHALLOW COVER ARE TO BE PROTECTED FROM DAMAGE BY CONSTRUCTION MACHINERY WITH ADEQUATE TEMPORARY COVER.
26. THE CONTRACTOR SHALL TAKE ALL THE NECESSARY PRECAUTIONS TO PROTECT ALL EXISTING UTILITIES. REPAIR TO DAMAGED UTILITIES SHALL BE AT THE CONTRACTOR'S EXPENSE.
27. ALL BORROW EXCAVATION SHALL BE A SOIL OR SOIL AGGREGATE MIXTURE AND SHALL CONFORM TO SECTION 916, MARYLAND STATE HIGHWAY ADMINISTRATION, STANDARD SPECIFICATIONS FOR CONSTRUCTION MATERIALS, LATEST EDITION.
28. DISPOSAL OF FILL, INCLUDING BUT NOT LIMITED TO EARTHEN SOILS, ROCK, RUBBLE, CONSTRUCTION DEBRIS, WOODY DEBRIS, AND TRASH, SHALL NOT BE PERMITTED IN SPECIAL FLOOD HAZARD AREAS.
29. SEE STANDARD NO. MD 578.01 "REPAIRING PAVEMENT OPENINGS FOR UTILITY TRENCHES" THE THE MDSHA'S STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES AND STANDARD NO. WI-101.01 "WICOMICO COUNTY, MARYLAND CONSTRUCTION STANDARDS ROADS, STREETS, AND INCIDENTAL STRUCTURES". THE WIDTH OF THE TRENCH SHALL BE IN ACCORDANCE WITH SECTION 303 OF MDSHA'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS" JULY 2008.
30. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXISTING ROADWAY REPAIR INCLUDING PATCHING.
31. THIS DRAWING DOES NOT INCLUDE THE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY. ALL CONSTRUCTION MUST BE DONE IN COMPLIANCE WITH THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 AND ALL RULES AND REGULATIONS THERETO APPURTENANT AND THE MARYLAND OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS.
32. WHERE EXCAVATION IS REQUIRED NEAR EXISTING UTILITY POLES, THE POLES SHALL BE BRACED AND/OR RELOCATED. THE COST SHALL BE INCLUDED IN THE BID.
33. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES OR STRUCTURES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES AND STRUCTURES BEFORE COMMENCING THE WORK.
34. THE CONTRACTOR SHALL COORDINATE HIS WORK SCHEDULE WITH THE OWNER. THE OWNER SHALL HAVE FINAL AUTHORITY ON THE CONTRACTOR'S WORK SCHEDULE.
35. McCRONE AND THE OWNER ARE NOT RESPONSIBLE FOR THE CONTRACTOR'S UTILIZATION OF WORKERS, MATERIALS, EQUIPMENT OR SAFETY MEASURES IN PERFORMANCE OF ANY WORK ON THIS PROJECT. THE CONTRACTOR ASSUMES ALL RESPONSIBILITY AND LIABILITY FOR PERFORMING THE WORK CORRECTLY AND IN CONFORMANCE WITH ALL APPLICABLE CODES AND REGULATIONS.
36. SHOULD THE CONTRACTOR DISCOVER DISCREPANCIES BETWEEN THE PLANS AND THE ACTUAL FIELD CONDITIONS ENCOUNTERED, THE OWNER AND ENGINEER SHALL BE NOTIFIED IMMEDIATELY TO ARRIVE AT AN ACCEPTABLE RESOLUTION.
37. THE CONTRACTOR SHALL RESTORE ALL DAMAGE TO ROADS, GRASS AREAS, SIDEWALK, PAVING, CURB & GUTTER AND GRAVEL AREAS UPON COMPLETION OF WORK AT NO ADDITIONAL COST TO OWNER AND TO THE SATISFACTION OF THE OWNER.
38. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AVOIDING AND/OR CLEANING UP DUST AND MUD ON ALL ROADS DUE TO VEHICLES ARRIVING AND LEAVING THE JOB SITE AS PART OF THIS WORK.
39. IT SHALL BE DISTINCTLY UNDERSTOOD THAT FAILURE TO MENTION SPECIFICALLY ANY WORK WHICH WOULD NORMALLY BE REQUIRED TO COMPLETE THE PROJECT SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO COMPLETE SUCH WORK.
40. ALL PLUGS, CAPS, TEES, AND BENDS, SHALL BE PROVIDED WITH CONCRETE BUTTRESSES UNLESS NOTED OTHERWISE.
41. WHEN A WATER MAIN IS IN CLOSE PROXIMITY OR CROSSES A SEWER MAIN, THE WATER LINES SHALL BE PLACED HIGHER THAN THE SEWER IF NON-POTABLE WATER LINES AND THE SEWER OR NON-POTABLE LINE SHALL BE ENCASED IN CONCRETE. A MINIMUM OF TEN (10) FEET ON EACH SIDE OF THE MAIN TO PROTECT THE WATER SUPPLY FROM POSSIBLE CONTAMINATION.
42. ALL MATERIAL SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
43. NO BUILDINGS WILL BE DEMOLISHED WITHIN THIS PROJECT
44. THE OWNER OR DEVELOPER SHALL CERTIFY RIGHT OF ENTRY FOR PERIODIC ON-SITE EVALUATION BY MDE COMPLIANCE INSPECTORS.

ENGINEER'S CERTIFICATION

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE 2011 STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2010 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II AND THE MARYLAND DEPARTMENT OF THE ENVIRONMENT EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT REGULATIONS.

DANIEL SPEAKMAN, PE DATE
McCRONE
119 W. NAYLOR MILL UNIT 3
SALISBURY, MD 21801

LICENSE NUMBER: 31400 EXPIRATION DATE: 1/16/2025

OWNER'S AND/OR DEVELOPER'S CERTIFICATION

I HEREBY CERTIFY THAT ANY CLEARING, GRADING, CONSTRUCTION, OR DEVELOPMENT WILL BE DONE PURSUANT TO THE APPROVED PLAN AND THAT RESPONSIBLE PERSONAL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OF TRAINING AT AN MDE APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION/SEDIMENT PRIOR TO BEGINNING THE PROJECT.

WICOMICO COUNTY MARYLAND DATE
GOVERNMENT OFFICE BUILDING
SALISBURY, MD 21801
PH:
EMAIL:

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

STRUCTURAL ENGINEER
EWINGCOLE

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McCRONE ENGINEERING

MEPFP ENGINEERS
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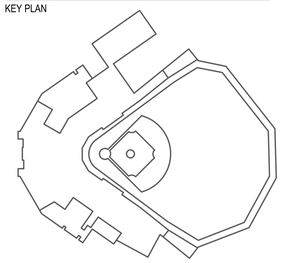
ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024
PROJECT NO. D2230059 SCALE NONE
DRAWING NAME

COVER SHEET

PHASE CD
DRAWING NO. C1

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EXISTING SOILS ON SITE		
MAP UNIT SYMBOL	MAP UNIT NAME	HYDROLOGIC SOIL GROUP
FmA	FORT MOTT LOAMY SAND, 0 TO 2 PERCENT SLOPES	A
LfA	LENNI SANDY LOAM, 0 TO 2 PERCENT SLOPES	D
PrA	PEPPERBOX- ROCKAWALKIN COMPLEX, 0 TO 2 PERCENT SLOPES	A
Up	URBAN LAND	N/A
TOTAL		

SHEET REFERENCES

A C3 EXISTING CONDITIONS PLAN

B C4 EXISTING CONDITIONS PLAN
C6 DEMOLITION PLAN

C C5 EXISTING CONDITIONS PLAN
C7 DEMOLITION PLAN

GRAPHIC SCALE
100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

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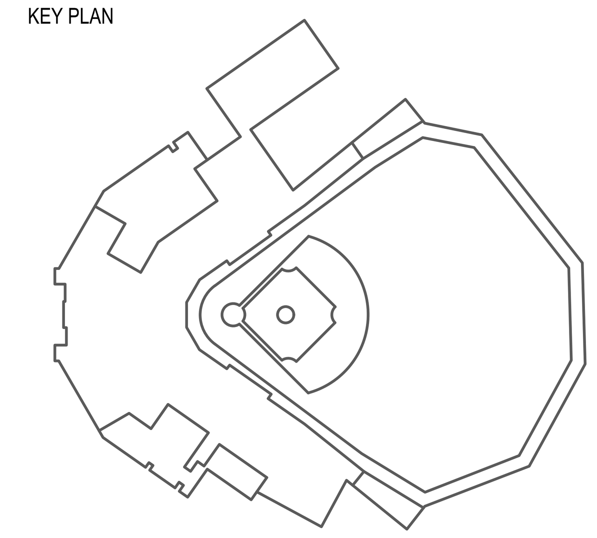

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OVERALL EXISTING CONDITIONS PLAN

PHASE CD

DRAWING NO. C2

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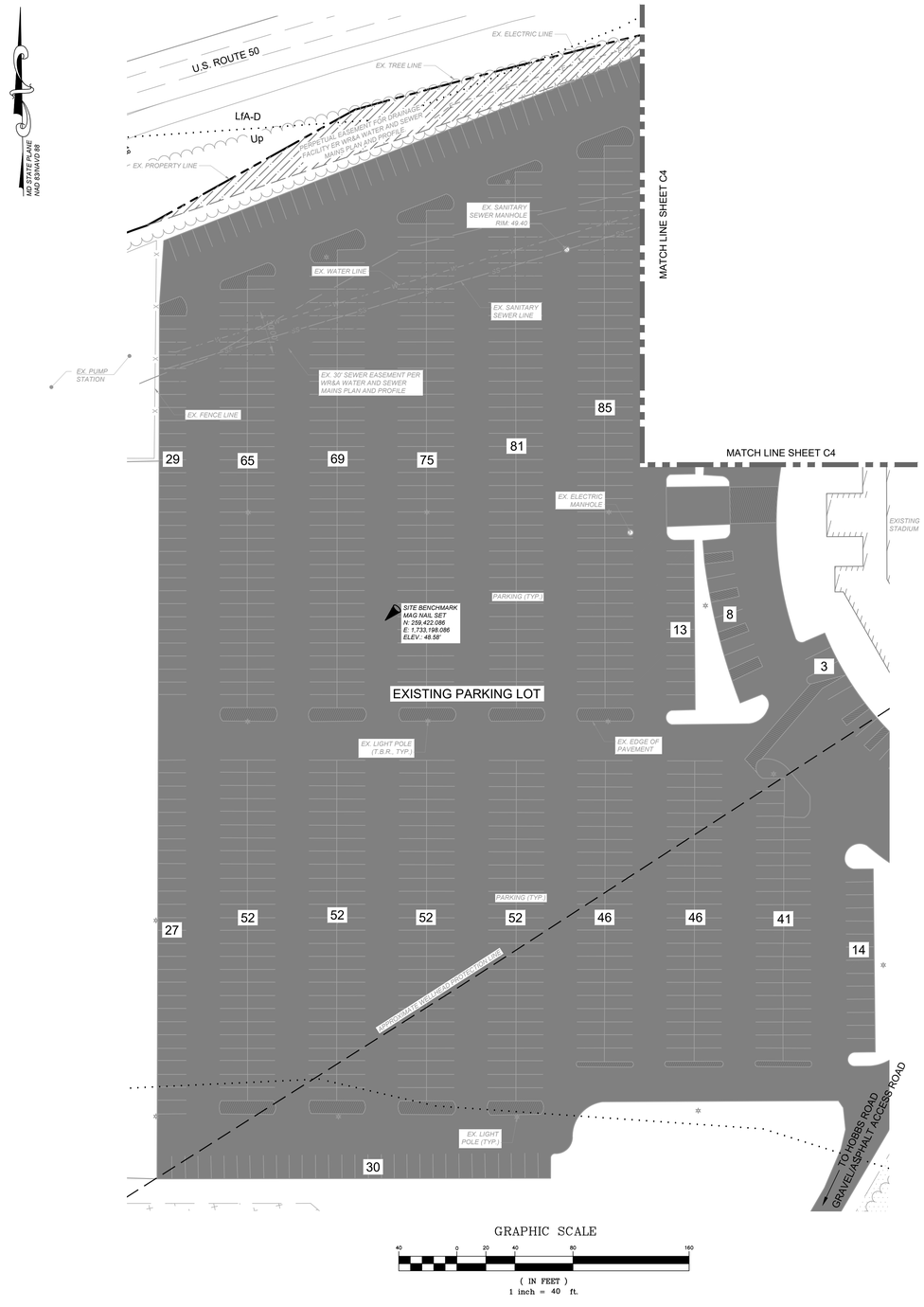

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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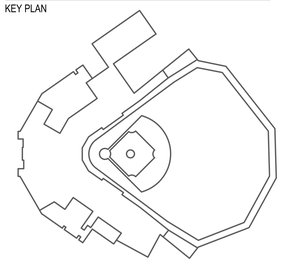

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EXISTING CONDITIONS PLAN

PHASE CD

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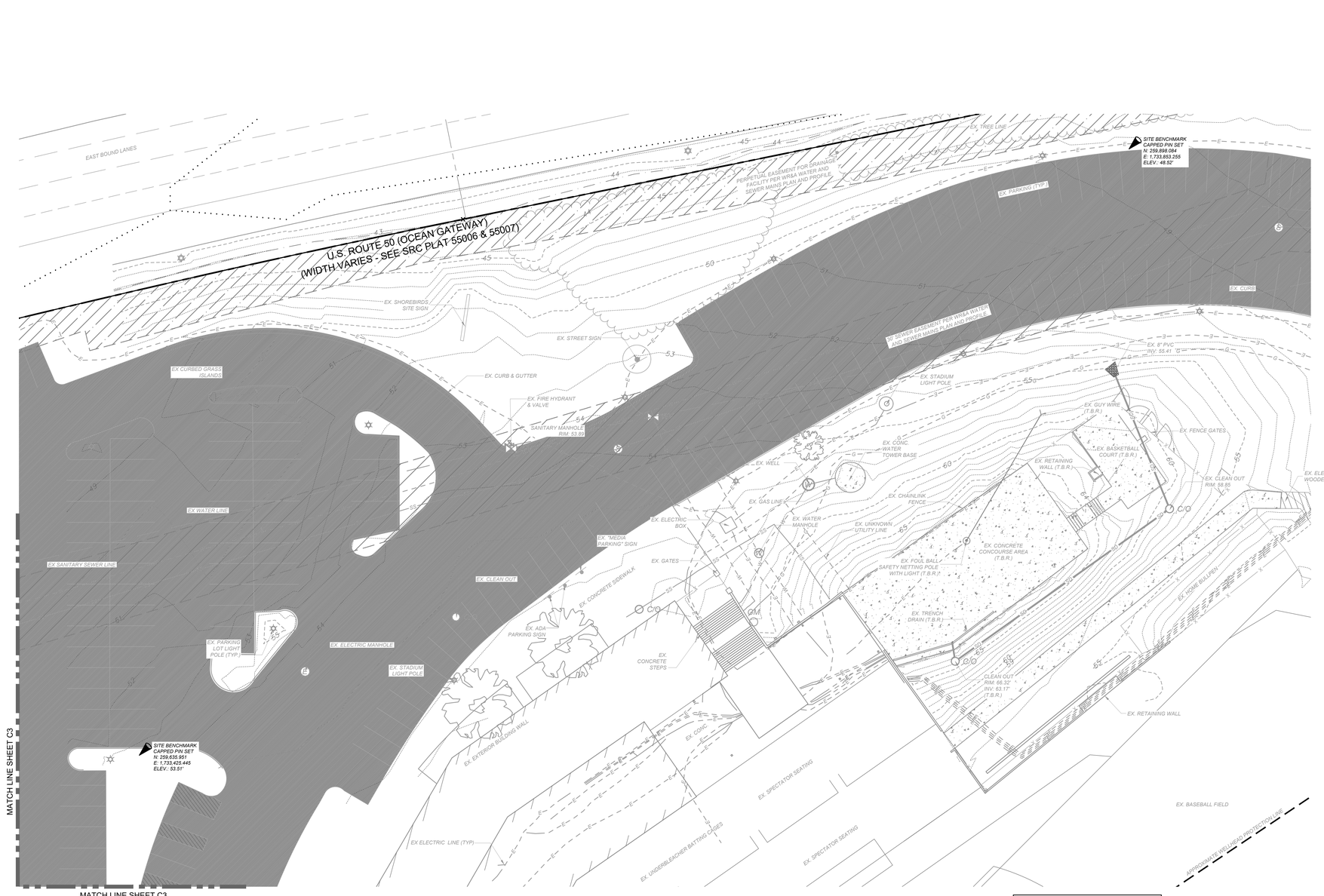

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

ABBREVIATIONS

T.R.	TO REMAIN
T.B.R.	TO BE REMOVED
EX.	EXISTING
PROP.	PROPOSED
TYP.	TYPICAL
CONC.	CONCRETE
INV.	INVERT
ARCH.	ARCHITECT
STRUC.	STRUCTURE

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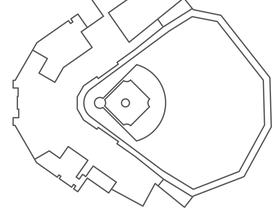

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EXISTING CONDITIONS PLAN

PHASE
CD

DRAWING NO.
C4

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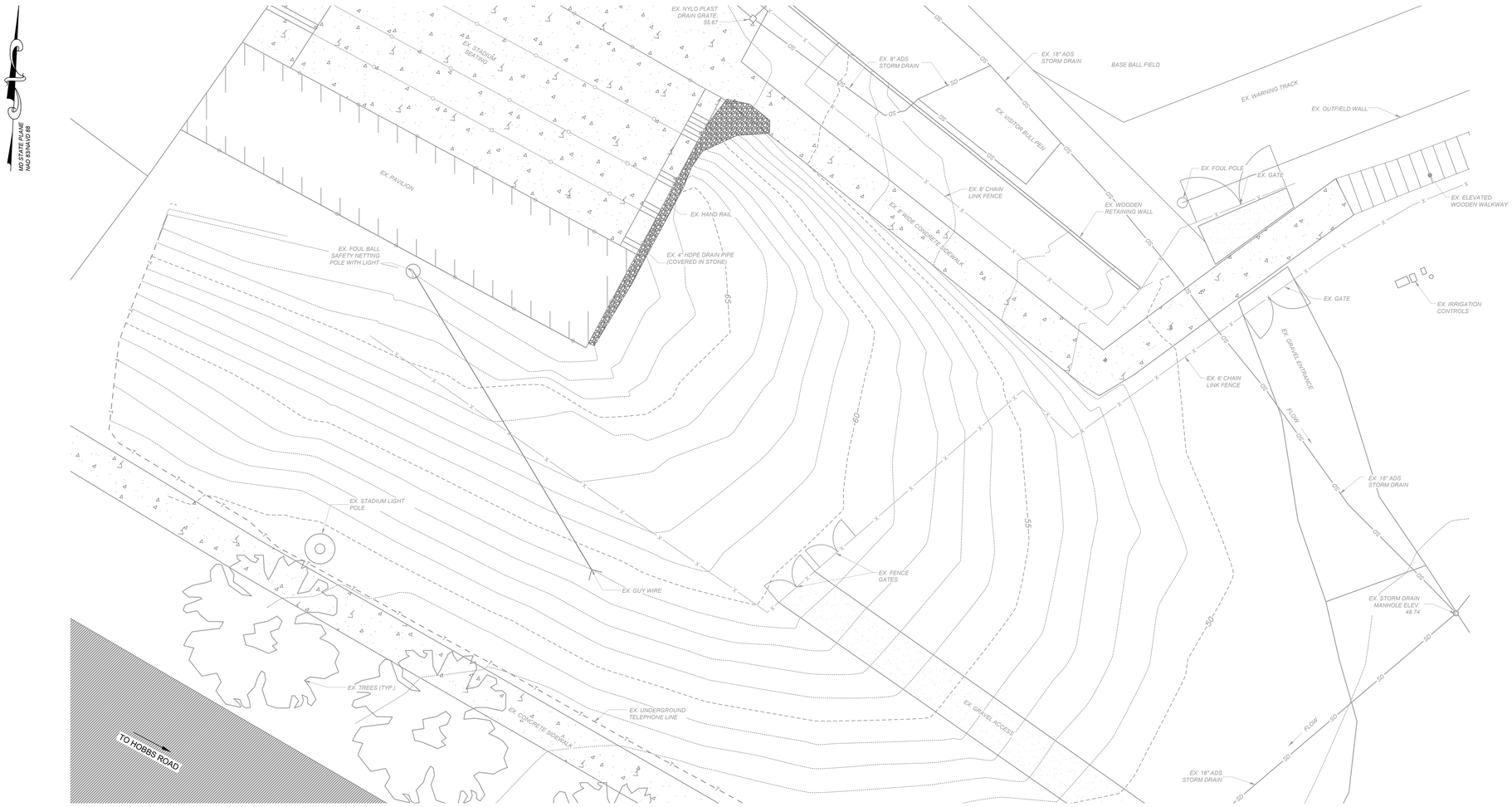

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

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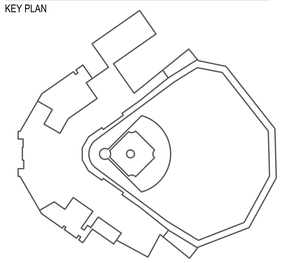

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EXISTING CONDITIONS PLAN

PHASE CD

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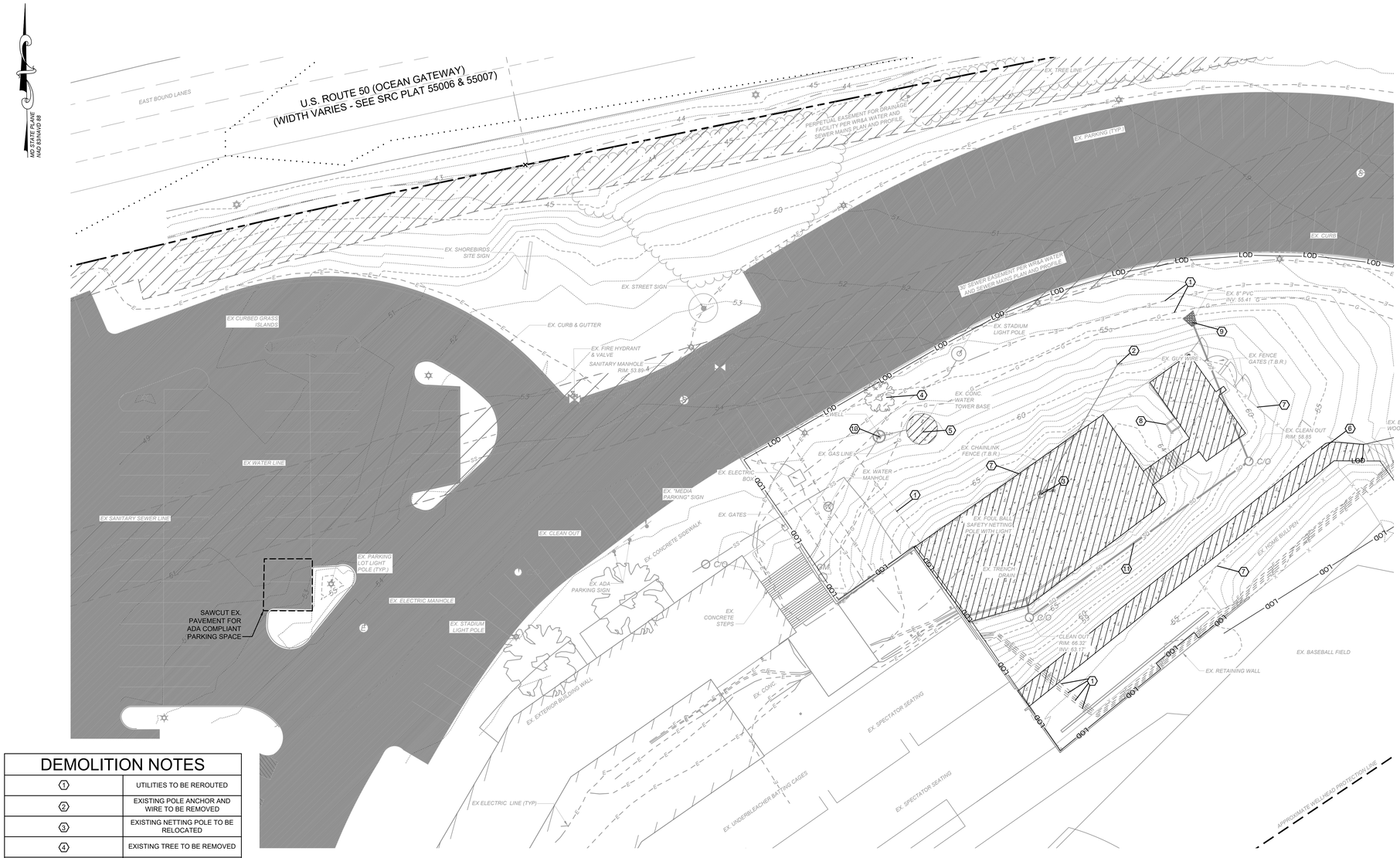

DEMOLITION NOTES

1	UTILITIES TO BE REROUTED
2	EXISTING POLE ANCHOR AND WIRE TO BE REMOVED
3	EXISTING NETTING POLE TO BE RELOCATED
4	EXISTING TREE TO BE REMOVED
5	EXISTING WATER TOWER BASE TO BE REMOVED
6	EXISTING CONCRETE TO BE REMOVED
7	EXISTING FENCE TO BE REMOVED
8	EXISTING WOODEN RETAINING WALL TO BE REMOVED
9	EXISTING RIP RAP TO BE REMOVED
10	EXISTING WELL TO BE ABANDONED
11	EXISTING DRAINAGE NETWORK TO BE REMOVED

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

MARYLAND STADIUM AUTHORITY
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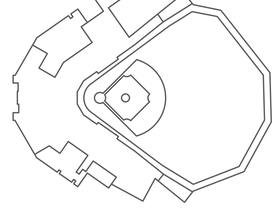
KEY PLAN



PRINCIPAL

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Project Architect

Project Model Lead

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALSBURY, MD, 21804

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PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

DEMOLITION PLAN

PHASE CD

DRAWING NO. C6

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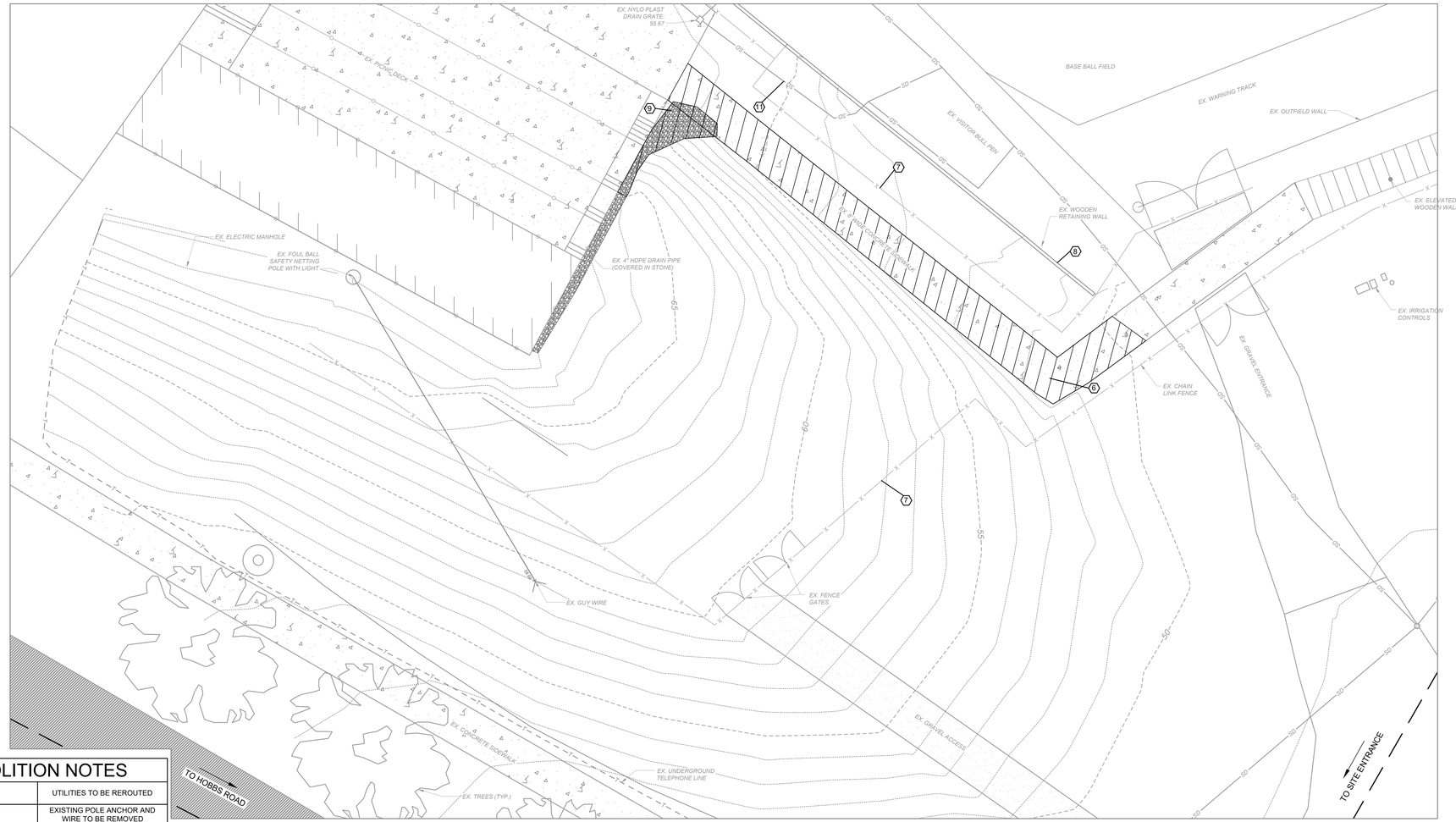

DEMOLITION NOTES

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11	EXISTING DRAINAGE NETWORK TO BE REMOVED

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)

1 inch = 10 ft.

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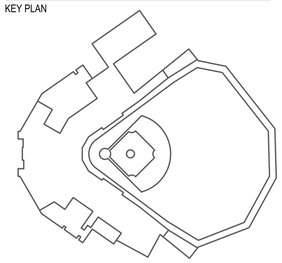
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024

PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

DEMOLITION PLAN

PHASE CD

DRAWING NO. C7

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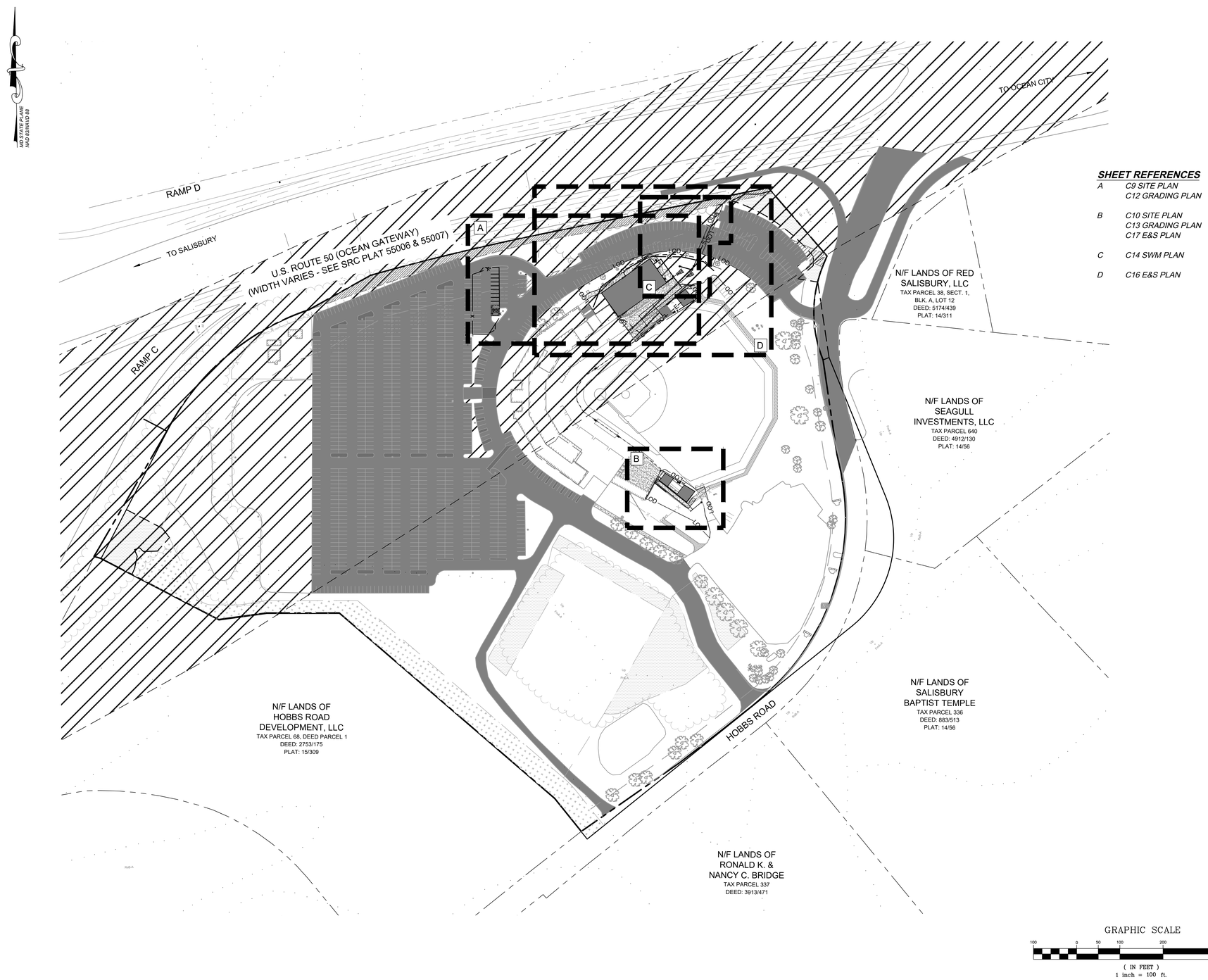


SHEET REFERENCES

A	*C9 SITE PLAN* *C12 GRADING PLAN*
B	*C10 SITE PLAN* *C13 GRADING PLAN* *C17 E&S PLAN*
C	*C14 SWM PLAN*
D	*C16 E&S PLAN*

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

MARYLAND STADIUM AUTHORITY
Est. 1986

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane

The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

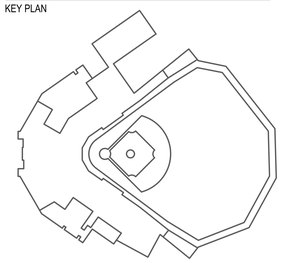
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024

PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

OVERALL SITE PLAN

PHASE CD

DRAWING NO. C8

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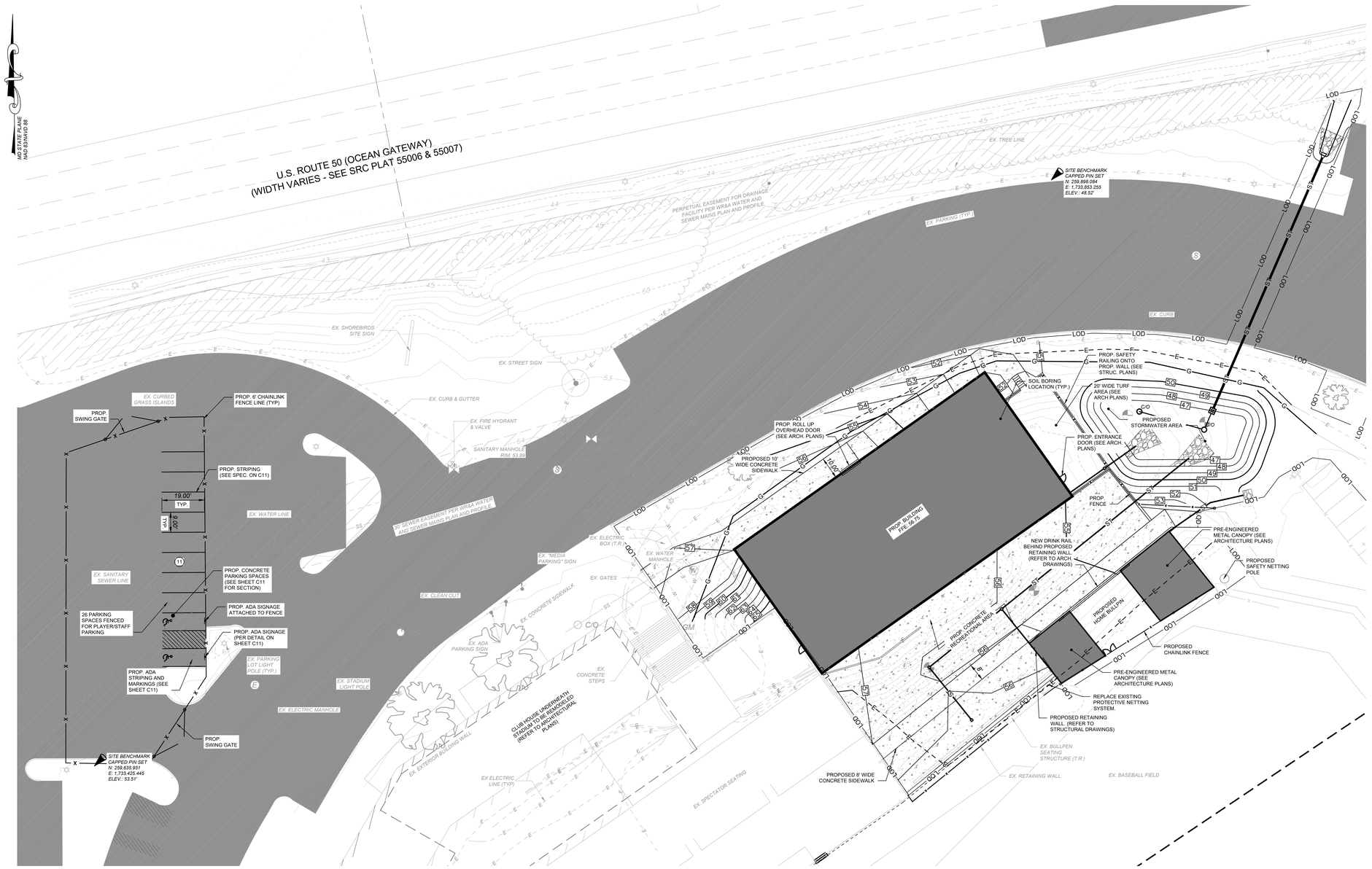

GRAPHIC SCALE

40 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

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Baltimore, MD 21201
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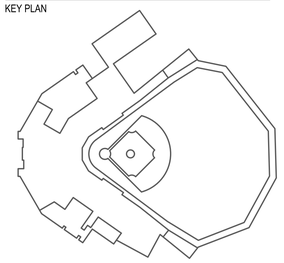

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6400 HOBBS ROAD,
SALSBURY, MD, 21804

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PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

SITE PLAN

PHASE
CD

DRAWING NO.
C9

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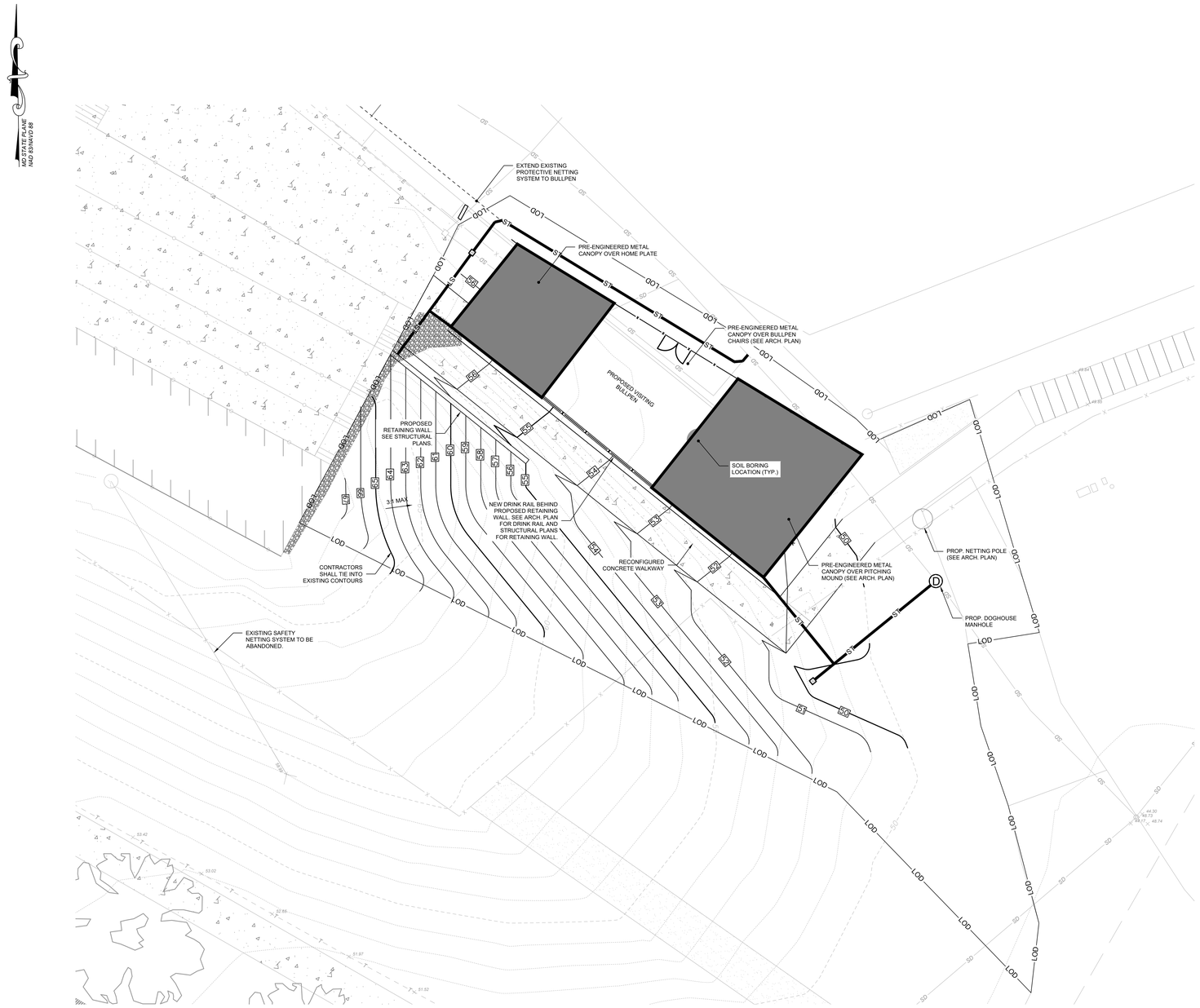

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

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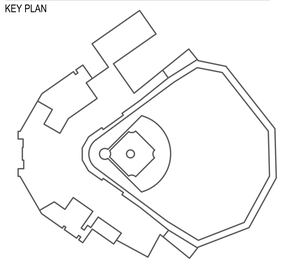

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SALSBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024

PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

SITE PLAN

PHASE
CD

DRAWING NO.
C10

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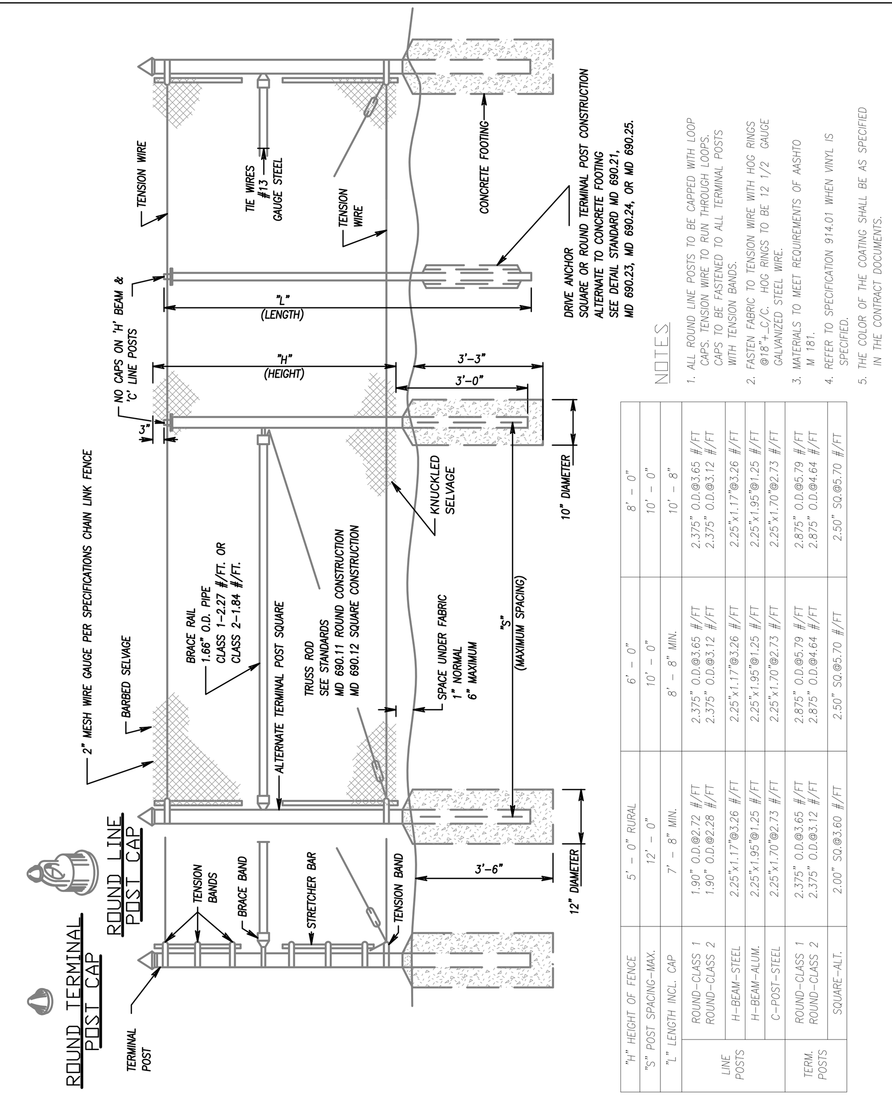
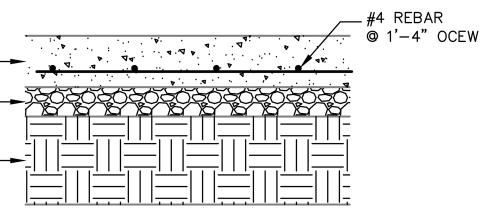


NOTES

1. ALL ROUND LINE POSTS TO BE CAPPED WITH LOOP CAPS. TENSION WIRE TO RUN THROUGH LOOPS. CAPS TO BE FASTENED TO ALL TERMINAL POSTS WITH TENSION BANDS.
2. FASTEN FABRIC TO TENSION WIRE WITH HOG RINGS @18"± C/C. HOG RINGS TO BE 12 1/2 GAUGE GALVANIZED STEEL WIRE.
3. MATERIALS TO MEET REQUIREMENTS OF AASHTO M 181.
4. REFER TO SPECIFICATION 914.01 WHEN VINYL IS SPECIFIED.
5. THE COLOR OF THE COATING SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.

"H" HEIGHT OF FENCE		5' - 0" RURAL	6' - 0"	8' - 0"
"S" POST SPACING-MAX.		12' - 0"	10' - 0"	10' - 0"
"L" LENGTH INCL. CAP		7' - 8" MIN.	8' - 8" MIN.	10' - 8"
LINE POSTS	ROUND-CLASS 1 ROUND-CLASS 2	1.90" O.D.@2.72 #/FT 1.90" O.D.@2.28 #/FT	2.375" O.D.@3.65 #/FT 2.375" O.D.@3.12 #/FT	2.375" O.D.@3.65 #/FT 2.375" O.D.@3.12 #/FT
	H-BEAM-STEEL	2.25"x1.17"@3.26 #/FT	2.25"x1.17"@3.26 #/FT	2.25"x1.17"@3.26 #/FT
	H-BEAM-ALUM.	2.25"x1.95"@1.25 #/FT	2.25"x1.95"@1.25 #/FT	2.25"x1.95"@1.25 #/FT
	C-POST-STEEL	2.25"x1.70"@2.73 #/FT	2.25"x1.70"@2.73 #/FT	2.25"x1.70"@2.73 #/FT
TERM. POSTS	ROUND-CLASS 1 ROUND-CLASS 2	2.375" O.D.@3.65 #/FT 2.375" O.D.@3.12 #/FT	2.875" O.D.@5.79 #/FT 2.875" O.D.@4.64 #/FT	2.875" O.D.@5.79 #/FT 2.875" O.D.@4.64 #/FT
	SQUARE-ALT.	2.00" SQ.@3.60 #/FT	2.50" SQ.@5.70 #/FT	2.50" SQ.@5.70 #/FT

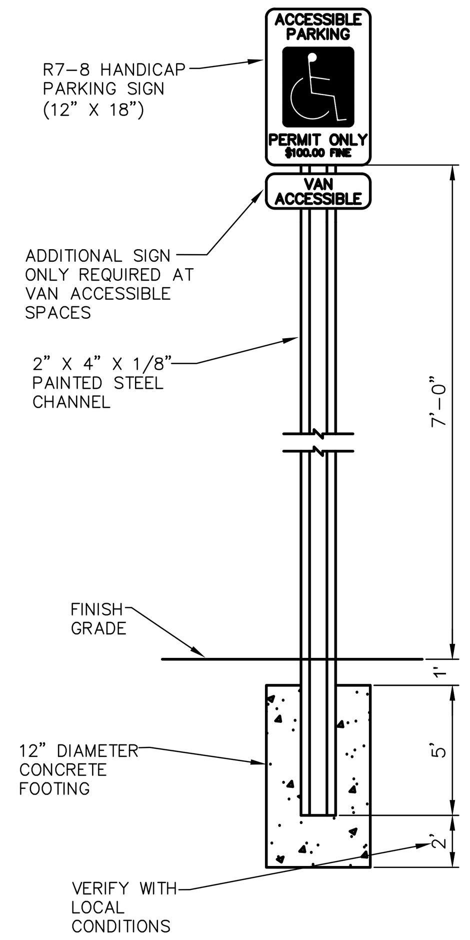
SPECIFICATION 607	CATEGORY CODE ITEMS	**Maryland Department of Transportation** **STATE HIGHWAY ADMINISTRATION** STANDARDS FOR HIGHWAYS AND INCIDENTAL STRUCTURES
APPROVED	DIRECTOR - OFFICE OF HIGHWAY DEVELOPMENT	CHAIN LINK FENCE TYPICAL 5 FT. RURAL 6 FT. & 8 FT
SHA State Highway Administration	APPROVAL • SHA REVISIONS: APPROVAL 6-4-84; REVISED 10-1-01; REVISED; REVISED APPROVAL • FEDERAL HIGHWAY ADMINISTRATION: APPROVAL 8-1-84; REVISED 10-10-89; REVISED; REVISED	STANDARD NO. MD 690.01



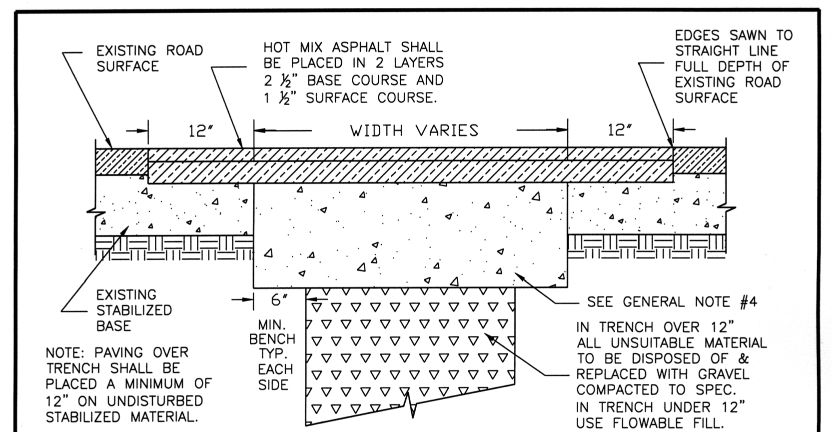
*ADD ALTERNATE #4 RECYCLED CONCRETE = 6" MIN

LIGHT CONCRETE PAVING SECTION

NOT TO SCALE



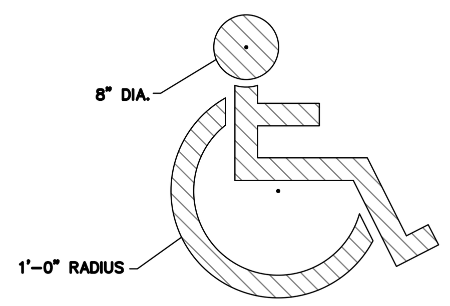
ADA HANDICAP SIGN



NOTE: PAVING OVER TRENCH SHALL BE PLACED A MINIMUM OF 12" ON UNDISTURBED STABILIZED MATERIAL.

1. A PERMIT MUST BE OBTAINED FROM THE DEPARTMENT OF PUBLIC WORKS FOR EXCAVATION OF ANY TRENCHES WITHIN THE RIGHT-OF-WAY LINES OF ANY WICOMICO COUNTY ROADS.
2. ANY TRENCHES WITHIN THE RIGHT-OF-WAY LINES OF ANY WICOMICO COUNTY ROADS SHALL BE BACKFILLED WITH SUITABLE MATERIAL. IF UNSUITABLE MATERIAL IS ENCOUNTERED, IT SHALL BE REMOVED AND REPLACED WITH BORROW EXCAVATION. MATERIAL REUSED, BORROW, COMPACTION AND MOISTURE CONTROL SHALL COMPLY WITH THE LATEST MD. STATE HIGHWAY ADMINISTRATION SPECIFICATIONS.
3. ALL PIPES SHALL BE INSTALLED PER THE MANUFACTURES RECOMMENDATIONS. TRENCHES SHALL HAVE A MINIMUM WIDTH OF THE PIPE PLUS ONE (1'-0") FOOT ON EACH SIDE.
4. THE TOP ONE (1'-0") FOOT OF THE STABILIZATION IN PAVED ROADS SHALL BE FILLED AND COMPACTED WITH STONE AGGREGRATE MEETING GRADATION REQUIREMENTS OF ASTM D 2940 CRUSHER RUN AGGREGATE (CR-6). MEASUREMENT REFERENCED TO BOTTOM OF PAVEMENT.
5. WHERE UTILITY TRENCHES ARE INSTALLED TRANSVERSE TO THE ROAD AND ARE MORE THAN 50 FEET APART, REPAVE BASED ON THIS DETAIL. OTHERWISE, INSTALL THE TRENCHES PER THIS DETAIL WITH BASE COURSE AND REPAVE THE SURFACE COURSE FOR THE ENTIRE ROAD WIDTH THE DISTANCE BETWEEN THE TRENCHES. FOR TRENCHES THAT DO NOT CROSS THE CENTERLINE, REPAVE HALF THE ROAD WIDTH FOR THE DISTANCE SPECIFIED.
6. WHERE UTILITY TRENCHES ARE INSTALLED PARALLEL TO THE ROAD AND DO NOT CROSS THE CENTERLINE, REPAVE HALF THE ROAD WIDTH FOR THE LENGTH OF THE TRENCH. IF THE TRENCH CROSSES THE CENTERLINE, REPAVE THE ENTIRE ROAD WIDTH.
7. IN AREAS WHERE TRENCHES ARE NOT IN THE PAVED AREAS, BACKFILL & COMPACTION SHALL MEET THE REQUIREMENTS IN NOTE 2 ABOVE. ALL DISTURBED AREAS SHALL THEN BE TOPSOILED, SEEDED AND MULCHED IN CONFORMANCE WITH MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL.

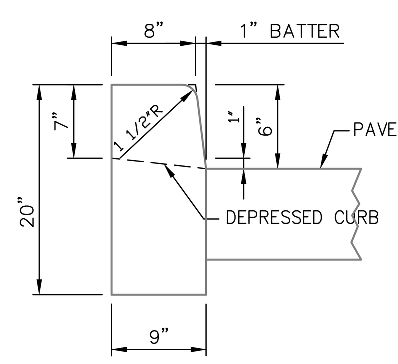
APPROVAL: [signature] 11/2/04 DIRECTOR - DEPARTMENT OF PUBLIC WORKS / DATE		WICOMICO COUNTY, MD DEPARTMENT OF PUBLIC WORKS REPAIRING PAVING OPENINGS
DRAWN BY: ELH	SCALE: 1"=1'	
DATE OF ORIGINAL DRAWING: 22 APR 97	DATE LAST REVISED: NOV 2004	STANDARD NO. WI-101.01



NOTES :
1. SYMBOL SHALL BE 3" WIDE (MIN.) AND PAINTED ON EACH HANDICAPPED SPACE.
2. HANDICAPPED SPACES SHALL BE 12'0" WIDE.

HANDICAPPED SYMBOL DETAIL

N.T.S

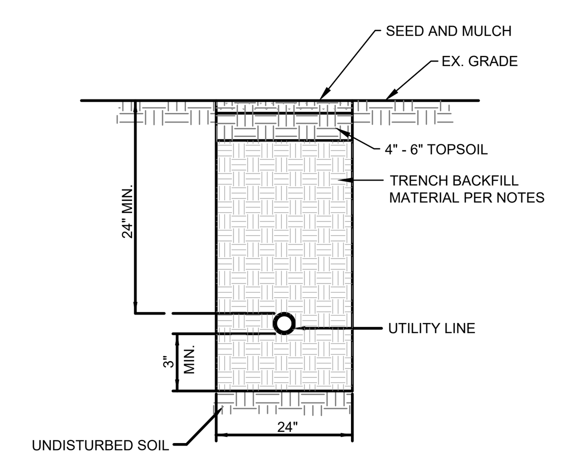


NOTES:

1. WHEN P.C.C. CURB OR INTEGRAL P.C.C. CURB AND GUTTER IS PLACED ADJACENT TO PORTLAND CEMENT CONCRETE PAVEMENT, CONSTRUCT THE JOINT AS PER THE LONGITUDINAL JOINT SEALANT DETAIL ON DETAIL P-2, SHEET 3 OF 5, USE APPROVED JOINT FILLLER TO SEAL. WORK TO BE PAID UNDER RESPECTIVE CURB AND GUTTER ITEM.
2. DEPRESS CURB AT ENTRANCES AND CURB RAMPS AS DETAILED ON THIS SHEET.
3. DEPRESS CURB FLUSH WITH PAVEMENT AT CURB RAMPS. MAXIMUM SLOPE OF CURB AT CURB RAMPS IS 20:1 IN THE DIRECTION OF PEDESTRAIN TRAVEL. SEE DETAIL C-2, SHEET 1 OF 4.
4. DEPRESS CURB FLUSH WITH PAVEMENT OR ADJACENT AREA AT NOSE OF ISLANDS, TAPERING BACK TO FULL HEIGHT AT A SLOPE OF 12:1.

STANDARD CONCRETE CURB DETAIL

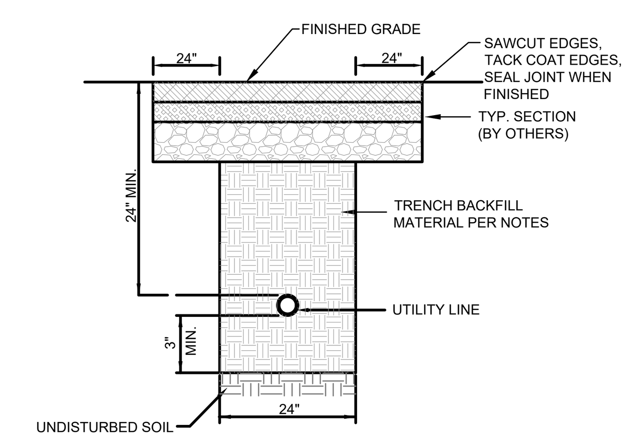
NOT TO SCALE



NOTES:
1. SEE GENERAL NOTES FOR TRENCH RESTORATION
2. WIDTH, GRADE, AREA, AND SLOPES SHALL MATCH EXISTING CONDITIONS.

TRENCH/DRILL PIT RESTORATION (LAWN)

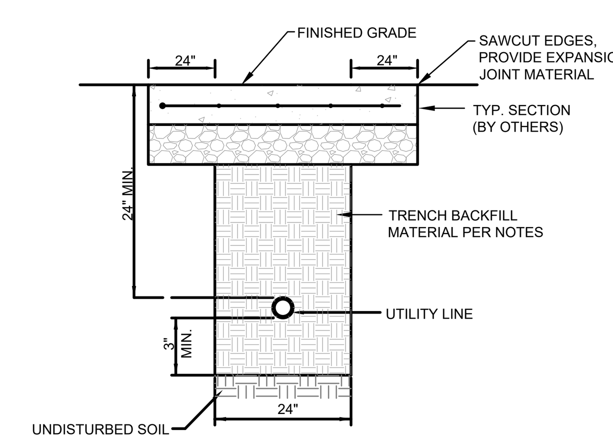
N.T.S.



NOTES:
1. SEE GENERAL NOTES FOR TRENCH RESTORATION
2. WIDTH, GRADE, AREA, AND SLOPES SHALL MATCH EXISTING CONDITIONS.

TRENCH/DRILL PIT RESTORATION (ASPHALT)

N.T.S.



NOTES:
1. SEE GENERAL NOTES FOR TRENCH RESTORATION
2. WIDTH, GRADE, AREA, AND SLOPES SHALL MATCH EXISTING CONDITIONS.

TRENCH/DRILL PIT RESTORATION (CONCRETE/SIDEWALK)

N.T.S.

GENERAL NOTES FOR TRENCH RESTORATION:

1. BACKFILL SHALL BE PLACED IN LIFTS NO LESS THAN 4" AND NO GREATER THAN 8 INCHES.
2. PROVIDE JOINT SEALANT WHERE NEW ASPHALT MEETS EXISTING ASPHALT OR CONCRETE.
3. WHERE TRENCH IMPACTS CONCRETE SIDEWALK OR SLAB, RESTORE CONCRETE TO NEAREST EXPANSION OR CONSTRUCTION JOINT. PROVIDE DOWELS EVERY 24" AROUND PERIMETER OF SAWCUT FOR SLAB RESTORATION
4. WHERE TRENCH IMPACTS WITHIN TWO FEET OF AN ADJACENT DISSIMILAR SURFACE, RESTORE TO EDGE OF DISSIMILAR SURFACE.
5. IN LAWN AREAS, TRENCH BACKFILL MATERIAL SHALL BE VIRGIN EXCAVATED TRENCH MATERIAL. COMPACTED TO 85% MODIFIED PROCTOR. WHERE EXCAVATED MATERIAL IS UNSUITABLE FOR COMPACTION DUE TO HIGH MOISTURE CONTENT, ORGANIC MATERIAL OR DEBRIS CONTENT, OR OTHER DELETERIOUS MATERIAL, USE SELECT FILL COMPACTED TO 85% MODIFIED PROCTOR.
6. IN NON-LAWN AREAS, TRENCH BACKFILL MATERIAL SHALL BE SELECT FILL COMPACTED TO 95% MODIFIED PROCTOR. VIRGIN MATERIAL MAY BE UTILIZED IF IT CAN MEET COMPACTION RATE AND IS APPROVED FOR USE BY THE GEOTECHNICAL INSPECTOR.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR DISPOSAL OF UNSUITABLE EXCAVATED MATERIAL ONSITE. CONTRACTOR SHALL COORDINATE DISPOSAL WITH OWNER.
8. IF GROUNDWATER IS ENCOUNTERED IN THE TRENCH, THE CONTRACTOR SHALL DESIGN A METHOD TO DEWATER THE TRENCH THAT DOES NOT IMPACT PREVIOUSLY PLACED BACKFILL MATERIAL OR ADJACENT IMPROVEMENTS. DISCHARGE OF SEDIMENT LADEN WATER IS STRICTLY PROHIBITED. GROUNDWATER SHALL BE DEWATERED WITH THE USE OF A FILTER BAG. CONTRACTOR MAY BE REQUIRED TO PERFORM TURBIDITY MONITORING; REFER TO SWPPP.

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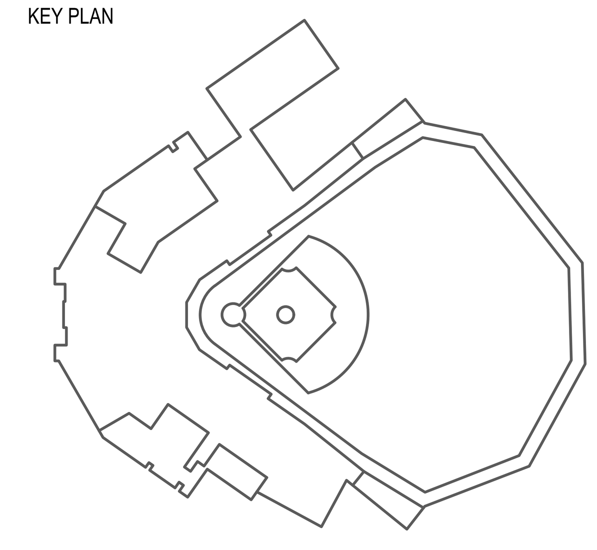

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

SITE DETAILS

PHASE: CD

DRAWING NO.: C11

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6/5/2009 9:00:21 AM File Path

MD STATE PLANE
NAD 83/HARN 88

PROP. BUILDING FFE: 56.75

PROPOSED MICRO-BIORETENTION STORMWATER FACILITY

PROP. TURF AREA FFE: 56.75

BOTTOM OF WALL 51.00
TOP OF WALL = 56.75

TOP OF WALL = 56.75

TOP OF WALL = 57.90

12" X 12" NYLOPLAST DRAIN RIM: 56.50

PROPOSED ROOF DRAIN FOR ENTIRE BUILDING

12" X 12" NYLOPLAST DRAIN GRATE: 54.98

12" X 12" NYLOPLAST DRAIN GRATE: 55.90

12" X 12" NYLOPLAST DRAIN GRATE: 55.88

12" X 12" NYLOPLAST DRAIN GRATE: 55.71

BW 49.58

PROPOSED BULLPEN AREA TO BE SLOPED TOWARDS PLAYING FIELD AT 0.50% (MIN.)

DOOR UNDERNEATH CONCRETE AREA EL. 56.75

TOP OF CONCRETE = 69.48
TOP OF SAND UNDERNEATH = 56.42

CONTRACTOR SHALL COORDINATE FOUNDATION EXPOSURE WITH ARCHITECT AND STRUCTURAL ENGINEER.

TOP OF WALL = 61.38

TOP OF WALL = 57.65

TW 55.92

TW 55.88

TW 55.84

TW 55.83*

EXISTING SPOT GRADE NOTE:
- *THESE SPOTS ARE NOT FIELD LOCATED BUT ARE INTERPOLATED BETWEEN FIELD LOCATED SPOTS*

APPROXIMATE WELLHEAD PROTECTION LINE

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)
1 inch = 10 ft.

GRAPHIC SCALE
40 0 10 20 40 80
(IN FEET)
1 inch = 20 ft.

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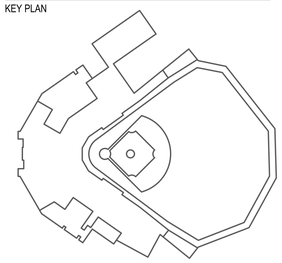
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

GRADING PLAN

PHASE	DRAWING NO.
CD	C12

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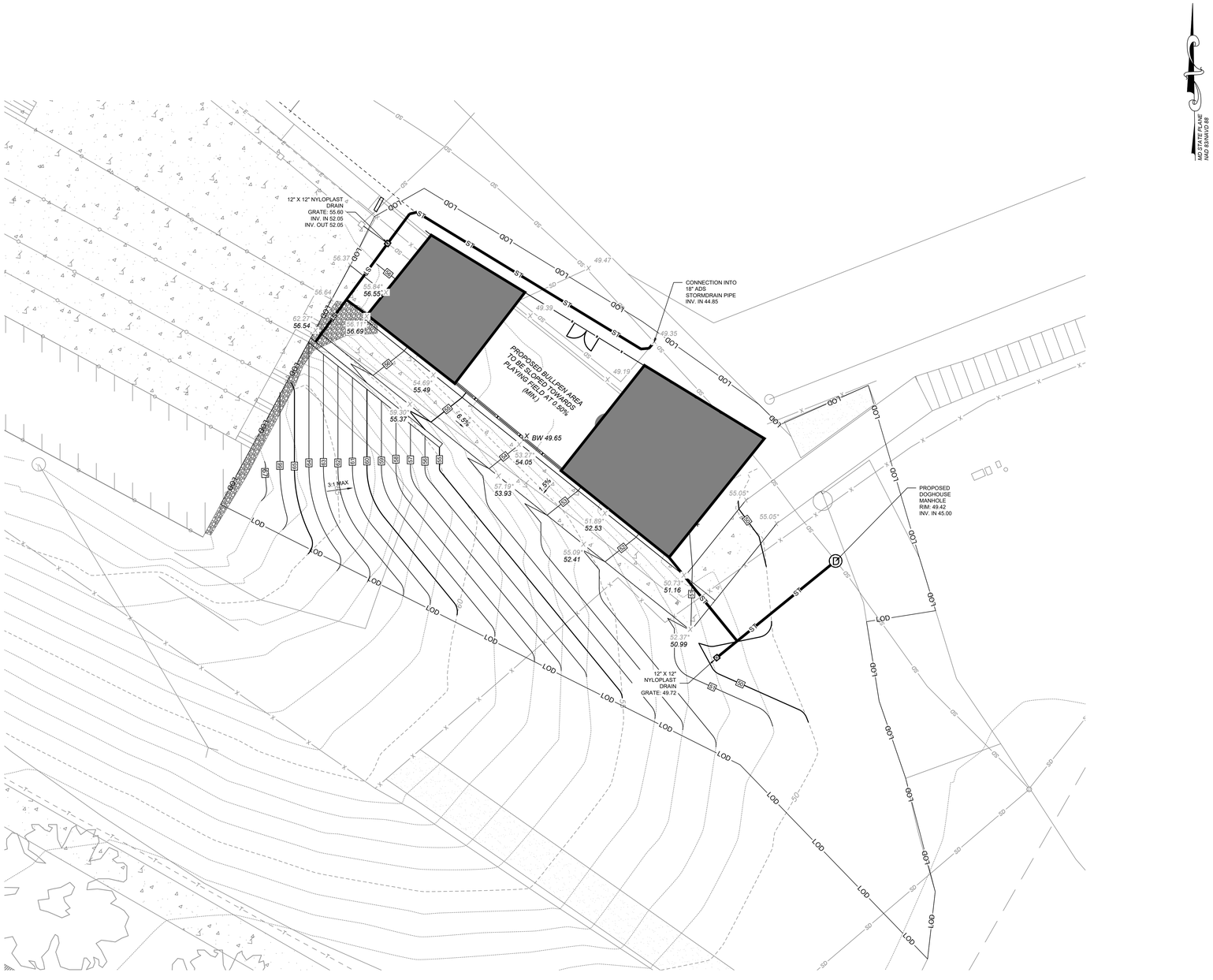
6/5/2009 9:00:21 AM File Path



GRAPHIC SCALE

(IN FEET)
1 inch = 10 ft.

EXISTING SPOT GRADE NOTE:
- *THESE SPOTS ARE NOT FIELD LOCATED BUT ARE INTERPOLATED BETWEEN FIELD LOCATED SPOTS*

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

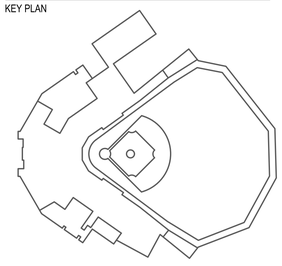
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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Project Architect

Project Model Lead

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D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

GRADING PLAN

PHASE: CD

DRAWING NO.: C13

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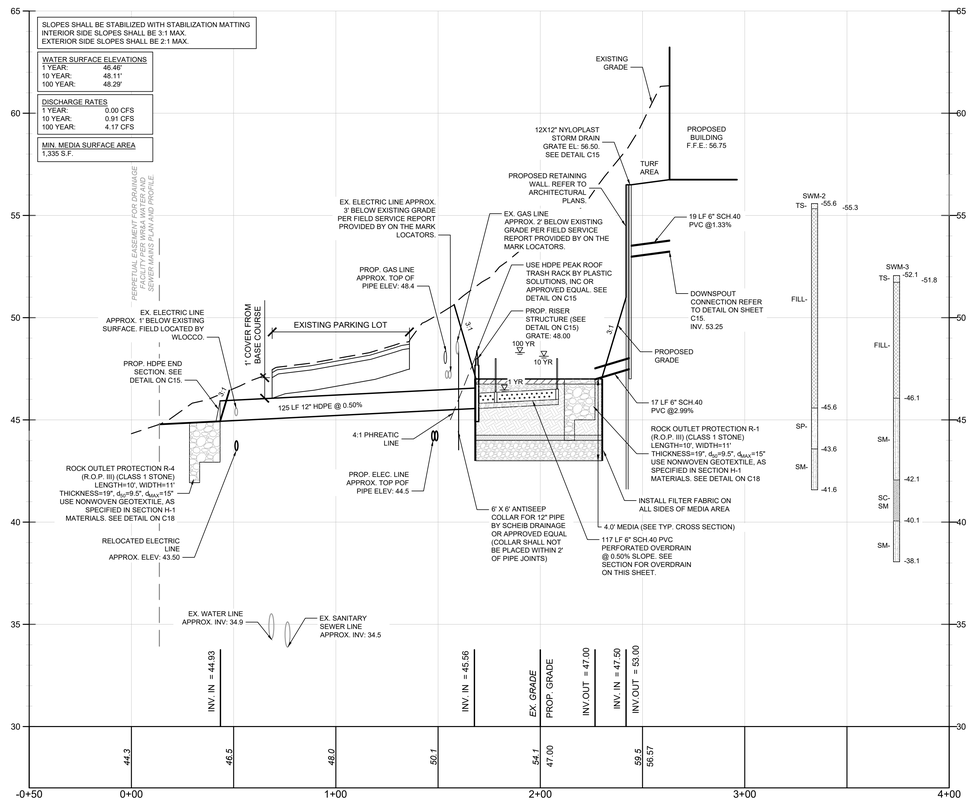
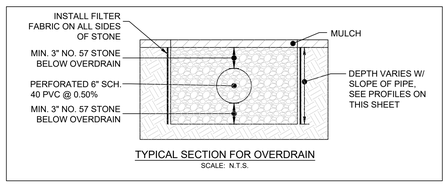


MBR-1 PROFILE

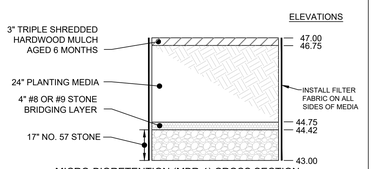
SCALE: H: 1" = 30'
V: 1" = 3'



TYPICAL SECTION FOR OVERDRAIN

SCALE: N.T.S.

***IF TRIPLE SHREDDED HARDWOOD MULCH CANNOT BE USED, ANOTHER NON-FLOATING ALTERNATIVE LIKE OYSTER SHELLS OR LANDSCAPE GRAVEL SHALL BE USED INSTEAD OF THE MULCH LAYER. IF LANDSCAPE GRAVEL IS BEING USED IT IS RECOMMENDED THAT WHITE OR LIGHT COLORED MATERIAL BE USED TO AVOID "BURNING" THE VEGETATION.



MICRO-BIORETENTION (MBR-1) CROSS SECTION

SCALE: N.T.S.

NOTE: RECHARGE VOLUME IS PROVIDED BELOW UNDERDRAIN

MBR-1 DESIGN DATA

1. DRAINAGE AREA = 0.56 AC
2. IMPERVIOUS AREA = 0.45 AC.
3. MAXIMUM ESD VOLUME AVAILABLE (Pe = 2.9") = 4,533 CF
4. AREA OF MEDIA = 1,335 SF
5. DEPTH OF MEDIA = 4 FT
6. Pe PROVIDED = 2.9"
7. ESDv PROVIDED = 3,722 CF / 0.75 = 4,963 CF
   According to the Stormwater Design Manual: "Micro-bioretention practices shall capture and store at least 75% of the ESD."
   ESDv CREDITED = 4,533 CF

M-6 MICRO-BIORETENTION MBR-1 SEQUENCE OF CONSTRUCTION

1. Stake out limits of disturbance. (1 day)
2. Notify the M.D.E. sediment control inspector (410) 901-4020 at least 48 hours prior to the start of construction or excavation. Note: It is recommended that construction of micro-bioretention be observed and documented by Engineer's representative (Civil or Geotechnical). Provide representative with photos documenting construction methods and material tickets. Failure to provide these items will prevent submittal of the As-built, which is required.
3. Install silt fence and super silt fence as shown on plan. Install riser structure.
4. Install embankment
5. Install 12" HDPE culvert, and anti-seep collar as shown on the plans. (1 day)
6. Excavate micro-bioretention facility to subgrade. (2 days)
   NOTE: Micro-bioretention facility requires inspections and construction documentation (refer to construction inspection schedule.) Failure to provide inspection reports and construction documentation will result in MDE rejecting the As-Built until adequate testing and documentation is provided. McCrone recommends construction observation and documentation by a Geotechnical Engineer.
7. Install filter fabric on sides of media area. (1/2 day)
8. Place bottom stone layer, bridging layer, planting media soil, stone, and overdrain. Cover with layer of mulch. (2 days)
9. Install landscaping in conformance with planting plan. (see Landscaping Plans) (1 day)
10. Permanently stabilize all disturbed areas with 6" topsoil, seed, and mulch. (1 days)
11. After obtaining permission from the sediment control inspector, remove all sediment control measures and stabilize any disturbed areas. A MDI licensed surveyor or engineer must survey constructed MBR and conveyances and submit As-built Plan to MDE for review. The as-built survey, plan, geotechnical engineer's report, and professional engineer's or surveyor's certification should be provided within 30 days following construction of the SWM facility.

Note:
1. Installation shall be in conformance with Appendix B.4 of the Maryland Stormwater Design Manual, Volumes I and II.
2. Installation of ESD practices shall not occur until the contributing drainage area has been completely stabilized and upon approval by inspector.

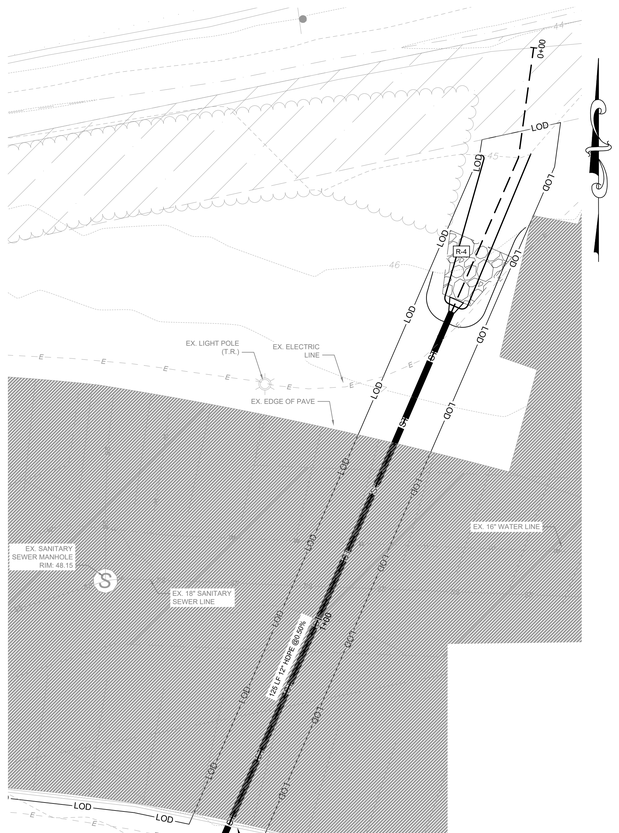
Owner Inspection and Maintenance Schedule for Micro-Bioretention Facilities

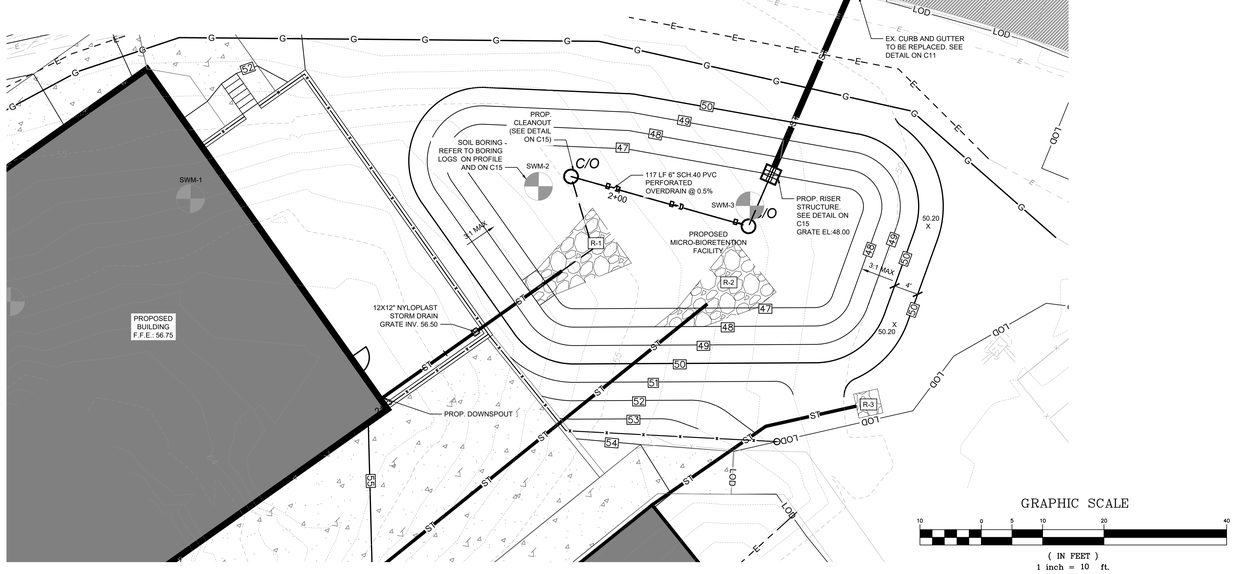
1. Practice shall be inspected at least twice annually - March and September.
2. During the first year of operation, inspection frequency should be after every major storm and poorly established areas revegetated.
3. Remove cap from observation well to determine if facilities are draining properly. If a facility does not completely drain within 48 hours after a rain event or more than 6" of sediment has accumulated, the underdrain pipes may need to be cleaned or the gravel media may need to be excavated and replaced.
4. Sediment accumulation on the surface of the facility should be removed and the top two to three inches of surface layer replaced as needed.
5. The top few inches of the planting soil should be removed and replaced when water ponds for more than 48 hours or there is algal growth on the surface of the facility.
6. If standing water persists after filter media has been maintained, the gravel, soil, and sand may need to be cleaned and/or replaced.
7. Occasional pruning and replacement of dead vegetation is necessary. If specific plants are not surviving, more appropriate species should be used. Watering may be required during prolonged dry periods.

Construction Inspection Schedule for Micro-Bioretention

Regular inspections shall be made during the following stages of construction:
1. During excavation to subgrade and placement and backfill of underdrain systems.
2. During placement of filter media.
3. During construction of appurtenant conveyance.
4. Upon completion of final grading and establishment of permanent stabilization.

Photographs and material tickets/receipts will be required for As-Built approval of ALL facilities. Field measurements may be required after excavation to subgrade. Please contact Engineer when practices are to be installed.





GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

MARYLAND STADIUM AUTHORITY
Est. 1986

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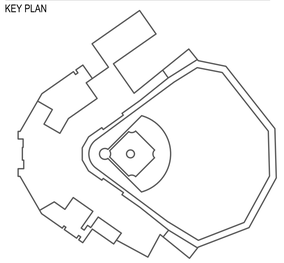
KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

STORMWATER MANAGMENT PLAN

PHASE	DRAWING NO.
CD	C14

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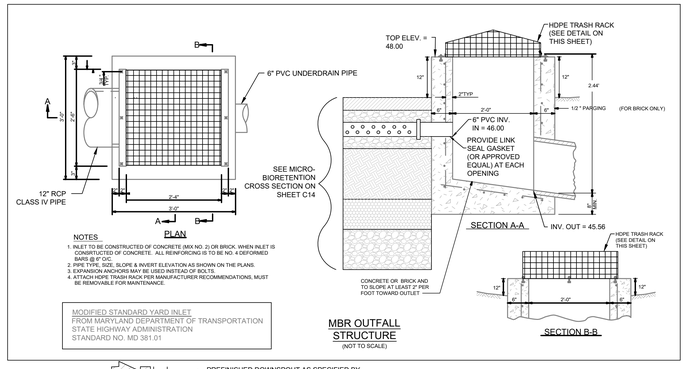
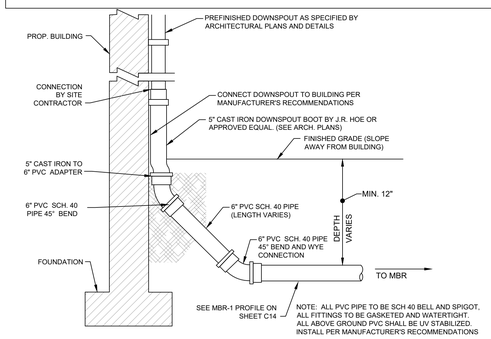
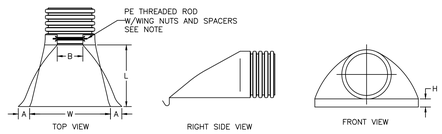


MBR OUTFALL STRUCTURE
(NOT TO SCALE)



DOWNSPOUT CONNECTION
N.T.S.

FLARED END SECTIONS



PART #	PIPE SIZE	A	B (MAX)	H	L	W
1210NP	12 in (300 mm)	6.50 in (165 mm)	10.00 in (254 mm)	6.50 in (165 mm)	25.00 in (635 mm)	29.00 in (737 mm)
1510NP	15 in (375 mm)	6.50 in (165 mm)	10.00 in (254 mm)	6.50 in (165 mm)	25.00 in (635 mm)	29.00 in (737 mm)
1810NP	18 in (450 mm)	7.50 in (191 mm)	15.00 in (381 mm)	6.50 in (165 mm)	32.00 in (813 mm)	35.00 in (889 mm)
2410NP	24 in (600 mm)	7.50 in (191 mm)	18.00 in (457 mm)	6.50 in (165 mm)	36.00 in (914 mm)	45.00 in (1143 mm)
3015NP	30 in (750 mm)	7.50 in (191 mm)	12.00 in (305 mm)	8.60 in (218 mm)	58.00 in (1473 mm)	63.00 in (1600 mm)
3615NP	36 in (900 mm)	7.50 in (191 mm)	25.00 in (635 mm)	8.60 in (218 mm)	58.00 in (1473 mm)	63.00 in (1600 mm)

NOTE: PE THREADED ROD W/WING NUTS PROVIDED FOR END SECTIONS 12"–24", 30" & 36" END SECTIONS REQUIRE TWO (2) THREADED RODS FOR ASSEMBLE.

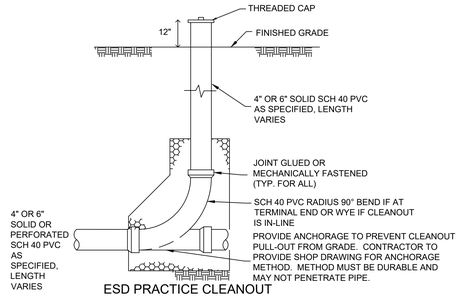
NOTE: ALL DIMENSIONS ARE NOMINAL

ADS ADVANCED DRAINAGE SYSTEMS, INC.

DRAWN BY	APPROVED BY	Material #
AWM 10.07.02	AWM 10.07.02	6070

REVISIONS	
BY	DATE
AWM	01.31.05

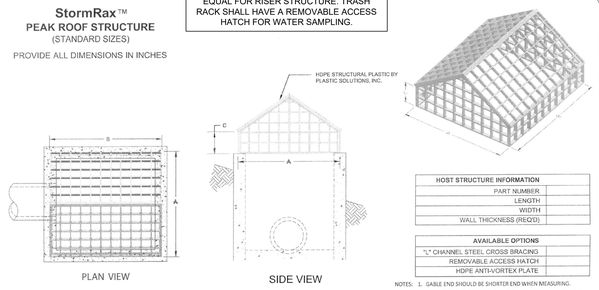
ESD PRACTICE CLEANOUT
N.T.S.



USE HDPE PEAK ROOF TRASH RACK BY PLASTIC SOLUTIONS, INC. OR APPROVED EQUAL FOR RISER STRUCTURE. TRASH RACK SHALL HAVE A REMOVABLE ACCESS HATCH FOR WATER SAMPLING.

StormRax™
PEAK ROOF STRUCTURE
(STANDARD SIZES)

PROVIDE ALL DIMENSIONS IN INCHES



HOST STRUCTURE INFORMATION	
PART NUMBER	
LENGTH	
WIDTH	
WALL THICKNESS (REQ'D)	

AVAILABLE OPTIONS	
"L" CHANNEL STEEL CROSS BRACING	
REMOVABLE ACCESS HATCH	
HDPE ANTI-VORTEX PLATE	

NOTES: 1. GABLE END SHOULD BE SHORTER END WHEN MEASURING.
2. MEASUREMENT CHANGES WILL OCCUR WHEN ACCESS DOOR IS NEEDED AND LADDER PLACEMENT IS DETERMINED.

DIMENSION CODES (A, B, C)

WIDTH A	29 1/8	36 13/16	45 13/16	54 11/16	66 7/16	72 5/16	81 5/16	90 5/16	99 1/2	108 3/8
CODE	03	04	05	06	07	08	09	10	11	12
LENGTH B	32 7/8	38 1/4	43 5/8	49	54 3/8	59 3/4	65 1/8	70 1/2	79 1/2	81 7/8
CODE	06	07	08	09	10	11	12	13	14	15
HEIGHT C	11 5/16	16 7/8								
CODE	02	03								
	2 Grids High	3 Grids High								

Peak Roof _____ " Width A _____ " Length B _____ " Height C

Plastic Solutions, Inc.
PO Box 4386, Winchester, VA 22604
238 McGhee Rd, Winchester, VA 22603
(877) 877-5727 phone
(540) 722-2219 fax
http://www.plastic-solution.com

CUSTOMER: | DATE:
PROJECT: | DRAWN BY:
APP'D BY:
DETAIL:

MD CODE 378 SMALL POND DETERMINATION

THE M-6 MICRO-BIORETENTION SHOWN ON THIS PLAN IS EXEMPT FROM SMALL POND APPROVAL DUE TO THE FOLLOWING:

1. THE STORAGE AT THE DESIGN HIGH WATER ELEVATIONS IS LESS THAN 40,000 CF.
100 YR STORM ELEVATION = 48.29 -> STORAGE = 4,287 CF.

2. THE HEIGHT OF THE EMBANKMENTS IS LESS THAN 6 FT.
MAXIMUM EMBANKMENT HEIGHT = 0.7 FT.

LOG OF BORING NO. SWM-2

Sheet 1 of 1

PROJECT: **Arthur W. Perdue Stadium Upgrades**
PROJECT NO.: **31240250**
PROJECT LOCATION: **Wicomico County, Maryland**
WATER LEVEL (ft): ▼Dry 14 | ▽ | ▼Dry 14
DATE: 2/28/24 | | 3/1/24
CAVED (ft): - | | -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**
WATER ENCOUNTERED DURING DRILLING (ft) ▽ **NE**
GROUND SURFACE ELEVATION: **55.6**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					55.6	0	TS		Topsoil: 3 inches	
1	0.0	20	3-4-5-5	9	55.3		FILL		Brown, moist, loose, Silty SAND (Fill)	
2	2.0	18	3-3-2-3	5		4			Brown, moist, loose, Poorly-graded SAND (Fill)	
3	4.0	24	3-3-2-4	5					Dark gray, moist, loose, Silty SAND (Fill)	
4	6.0	24	2-5-2-2	7		8			Brown, moist, loose, Poorly-graded SAND (Fill)	
5	8.0	24	2-4-5-4	9	45.6					
6	10.0	20	2-2-2-2	4		12	SP		Tan, moist, very loose, Poorly-graded SAND USDA: Sand	
7	12.0	24	2-3-4-5	7	43.6		SM		Brown, moist, loose, Silty SAND USDA: Sandy Loam	
					41.6	16			Bottom of hole 14 feet	
						20				
						24				

NOTES: **Air Temp.: 67, 48 Hr. Precip.: 0.0 in., Coords: 38022'14.56"N, 75031'46.51"W**
ASTM 1586, NE = Not Encountered

GEO-TECHNOLOGY ASSOCIATES, INC.
21491 Baltimore Avenue, Suite 1
Georgetown, DE 19947

LOG OF BORING NO. SWM-2
Sheet 1 of 1

LOG OF BORING NO. SWM-3

Sheet 1 of 1

PROJECT: **Arthur W. Perdue Stadium Upgrades**
PROJECT NO.: **31240250**
PROJECT LOCATION: **Wicomico County, Maryland**
WATER LEVEL (ft): ▼Dry 14 | ▽ | ▼Dry 14
DATE: 2/28/24 | | 3/1/24
CAVED (ft): - | | -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**
WATER ENCOUNTERED DURING DRILLING (ft) ▽ **NE**
GROUND SURFACE ELEVATION: **52.1**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

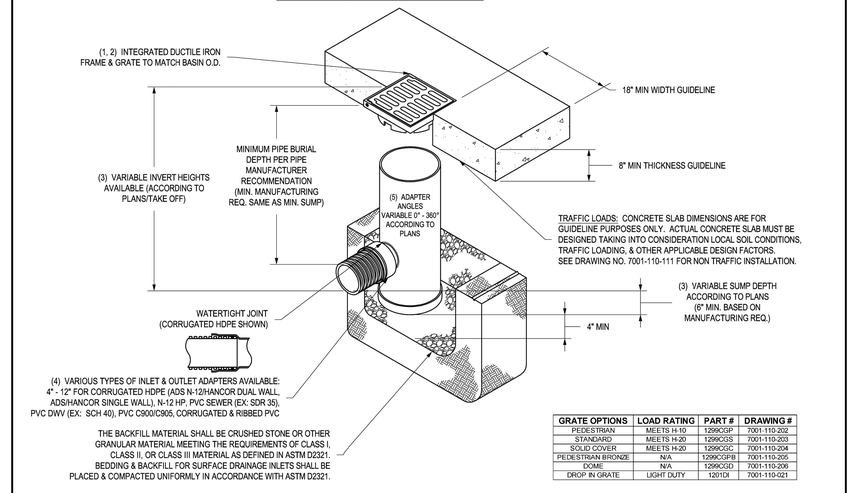
SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					52.1	0	TS		Topsoil: 4 inches	
1	0.0	24	2-3-3-3	6	51.8		FILL		Brown-tan, moist, loose to medium dense, Poorly-graded SAND (Fill)	
2	2.0	24	4-3-3-6	6		4				
3	4.0	22	3-4-7-7	11						
4	6.0	24	7-9-10-8	19	46.1	8	SM		Brown, moist, very loose to medium dense, Silty SAND USDA: Sandy Loam	
5	8.0	17	1-2-1-8	3						
6	10.0	24	3-3-4-4	7	42.1		SC-SM		Brown-gray, moist, loose, Silty, Clayey SAND USDA: Sandy Clay Loam	
7	12.0	20	5-5-4-2	9	40.1	12	SM		Gray-tan, moist, loose, Silty SAND USDA: Sandy Loam	
					38.1	16			Bottom of hole 14 feet	
						20				
						24				

NOTES: **Air Temp.: 67, 48 Hr. Precip.: 0.0 in., Coords: 38022'14.53"N, 75031'46.08"W**
ASTM 1586, NE = Not Encountered

GEO-TECHNOLOGY ASSOCIATES, INC.
21491 Baltimore Avenue, Suite 1
Georgetown, DE 19947

LOG OF BORING NO. SWM-3
Sheet 1 of 1

NYLOPLAST 12" DRAIN BASIN: 2812AG _ _ X



GRATE OPTIONS	LOAD RATING	PART #	DRAWING #
PEDESTRIAN	MEETS H-10	1299CGP	7001-110-202
STANDARD	MEETS H-20	1299CGS	7001-110-203
SOLID COVER	MEETS H-20	1299CGC	7001-110-204
PEDESTRIAN BRONZE	N/A	1299CGPB	7001-110-205
DOME	N/A	1299CGD	7001-110-206
DROP IN GRATE	LIGHT DUTY	1201DI	7001-110-021

1 - GRATES/SOLID COVER SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05, WITH THE EXCEPTION OF THE BRONZE GRATE.
2 - FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER.
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.

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DRAWN BY EBC | MATERIAL
DATE 03-29-06
REVISED BY NMH | PROJECT NO./NAME
DATE 03-11-16
DWG SIZE A | SCALE 1:20 | SHEET 1 OF 1

ADS Nyloplast
3130 VERONA AVE
BUFORD, GA 30518
PHN (770) 932-2443
FAX (770) 932-2490
www.nyloplast-us.com

TITLE
12 IN DRAIN BASIN QUICK SPEC INSTALLATION DETAIL

DWG NO. 7001-110-189 REV E

MARYLAND STADIUM AUTHORITY Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
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EWING COLE
810 Light Street
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The Liberty Building at McHenry Row
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STRUCTURAL ENGINEER
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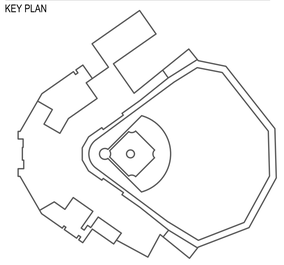
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY TW | DATE 6/15/2024
PROJECT NO. D2230059 | SCALE NONE
DRAWING NAME

STORMWATER MANAGEMENT DETAILS

PHASE
CD

DRAWING NO.
C15

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6/5/2009 9:00:21 AM

STANDARD STABILIZATION NOTE:

FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORITONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.

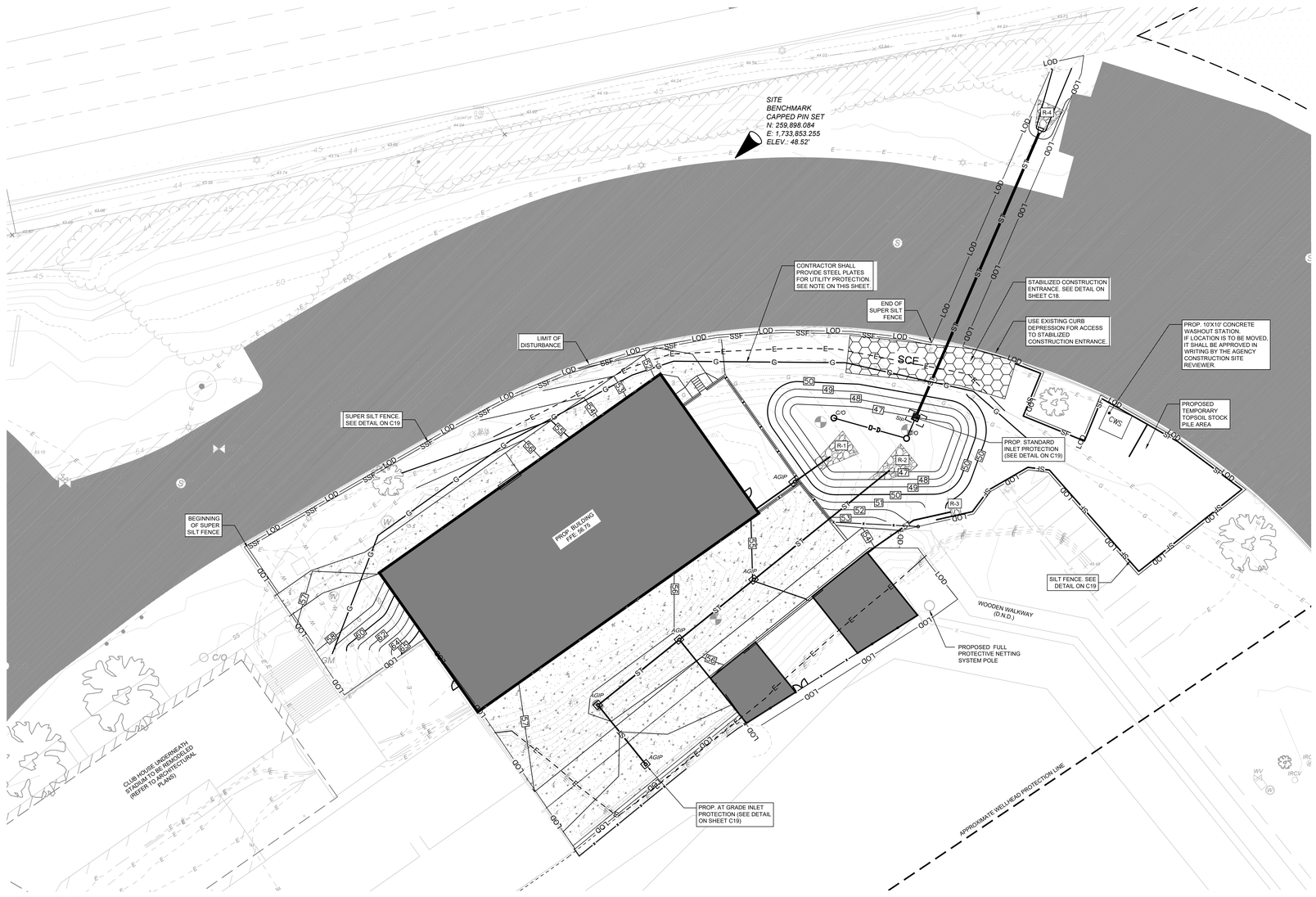
UTILITY NOTE:

CONTRACTOR SHALL PROTECT EXISTING UTILITIES WITHIN LIMIT OF DISTURBANCE. CONTRACTOR SHALL CONFIRM DEPTH TO HIS SATISFACTION PRIOR TO COMMENCING WORK. CONTRACTOR MAY NEED TO PROVIDE STEEL PLATES TO PROTECT GAS AND OTHER UTILITIES. ANY DAMAGE TO UTILITIES SHALL BE REPAIRED BY THE CONTRACTOR.

ROCK OUTLET PROTECTIONS

ROCK OUTLET PROTECTION (R.O.P. III) (CLASS I STONE). USE NONWOVEN GEOTREXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS. SEE DETAIL ON C17

- R-1 LENGTH = 10', WIDTH = 11' D_{50}=9.5", D_{MAX} = 15"
- R-2 LENGTH = 10', WIDTH = 11' D_{50}=9.5", D_{MAX} = 15"
- R-3 LENGTH = 4', WIDTH = 4' D_{50}=9.5", D_{MAX} = 15"
- R-4 LENGTH = 10', WIDTH = 11' D_{50}=9.5", D_{MAX} = 15"



NOTE TO CONTRACTOR:
EROSION/SEDIMENT CONTROL WILL BE STRICTLY ENFORCED

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

MARYLAND STADIUM AUTHORITY Est. 1986

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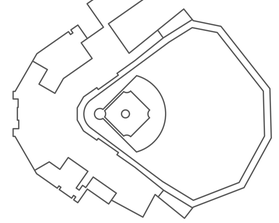
KEY PLAN



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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALISBURY, MD, 21804

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PROJECT NO. D2230059 SCALE NONE

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EROSION & SEDIMENT CONTROL PLAN

PHASE CD

DRAWING NO. C16

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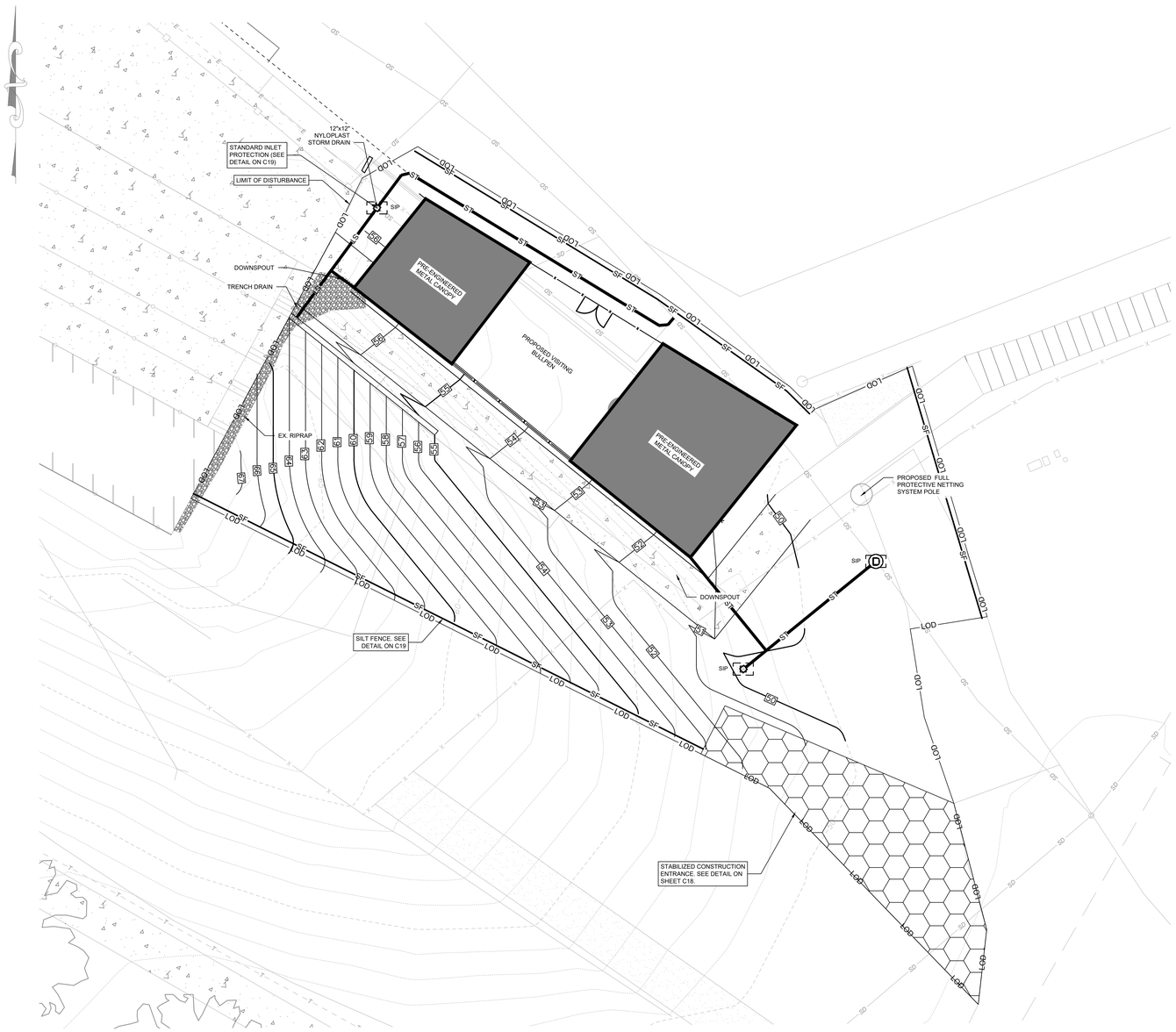

NOTE TO CONTRACTOR:
EROSION/SEDIMENT CONTROL WILL BE STRICTLY ENFORCED

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

H-5 STANDARDS AND SPECIFICATIONS FOR DUST CONTROL

DEFINITION:
CONTROLLING THE SUSPENSION OF DUST PARTICLES FROM CONSTRUCTION ACTIVITIES.

PURPOSE:
TO PREVENT BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES TO REDUCE ON AND OFF-SITE DAMAGE INCLUDING HEALTH AND TRAFFIC HAZARDS.

CONDITIONS WHERE PRACTICE APPLIES:
AREAS SUBJECT TO DUST BLOWING AND MOVEMENT WHERE ON AND OFF-SITE DAMAGE IS LIKELY WITHOUT TREATMENT.

SPECIFICATIONS:
1. MULCHES: SEE SECTION B-4-2 SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS, SECTION B-4-3 SEEDING AND MULCHING, AND SECTION B-4-4 TEMPORARY STABILIZATION. MULCH MUST BE ANCHORED TO PREVENT BLOWING.
2. VEGETABLE COVER: SEE SECTION B-4-4 TEMPORARY STABILIZATION.
3. TILLAGE: TILL TO ROUGHEN SURFACE AND BRING CLODS TO THE SURFACE. BEGIN PLOWING ON WINDWARD SIDE OF SITE. CHISEL-TYPE PLOWS SPACED ABOUT 12 INCHES APART, SPRING-TOOTHED HARROWS, AND SIMILAR PLOWS ARE EXAMPLES OF EQUIPMENT THAT MAY PRODUCE THE DESIRED EFFECT.
4. IRRIGATION: SPRINKLE SITE WITH WATER UNTIL THE SURFACE IS MOIST. REPEAT AS NEEDED. THE SITE MUST NOT BE IRRIGATE TO THE POINT THAT RUNOFF OCCURS.
5. BARRIERS: SOLID BOARD FENCES, SILT FENCES, SNOW FENCES, BURLAP FENCES, STRAW BALES, AND SIMILAR MATERIALS CAN BE USED TO CONTROL AIR CURRENTS AND SOIL BLOWING.
6. CHEMICAL TREATMENT: USE OF CHEMICAL TREATMENT REQUIRES APPROVAL BY THE APPROPRIATE PLAN REVIEW AUTHORITY.

SEQUENCE OF CONSTRUCTION

1. OBTAIN ALL REQUIRED PERMITS.
2. MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE) SHALL BE NOTIFIED IN WRITING 5 DAYS PRIOR TO COMMENCING WITH CONSTRUCTION. FAILURE TO DO SO CONSTITUTES A VIOLATION OF THE APPROVED SEDIMENT AND STORMWATER MANAGEMENT PLAN.
3. COORDINATE CONSTRUCTION TIMELINE WITH SHOREBIRDS TO PREVENT DISRUPTIONS TO ONSITE ACTIVITIES. PLEASE CONTACT SHOREBIRDS PROJECT MANAGER FOR TIMELINE COORDINATION AND SITE ACCESS.
4. PRIOR TO ANY INSTALLATION OF SEDIMENT CONTROL MEASURES OR GRADING, A PRE-CONSTRUCTION MEETING SHALL BE SCHEDULED AND CONDUCTED WITH THE AGENCY CONSTRUCTION SITE REVIEWER. THE LANDOWNER/DEVELOPER, CONTRACTOR, AND THIRD PARTY CERTIFIED GREEN CARD HOLDER (CCR) ARE REQUIRED TO BE IN ATTENDANCE AT THE PRE-CONSTRUCTION MEETING. THE DESIGNER IS RECOMMENDED TO ATTEND.
5. STAKE OUT LIMIT OF DISTURBANCE.
6. GRADE AND INSTALL STABILIZED CONSTRUCTION ENTRANCE. CONSTRUCTION TRAFFIC MUST USE STABILIZED CONSTRUCTION ENTRANCE TO ENTER AND EXIT SITE. INSTALL PERIMETER SILT AND SUPER SILT FENCE. SET UP STAGING AREA.
7. ALL PERIMETER CONTROLS ARE TO BE REVIEWED BY THE AGENCY CONSTRUCTION SITE REVIEWER AND APPROVED PRIOR TO PROCEEDING WITH FURTHER SITE DISTURBANCE OR CONSTRUCTION.
8. THE CONTRACTOR SHALL AT ALL TIMES PROTECT AGAINST SEDIMENT OR DEBRIS LADEN RUNOFF OR DUST FROM LEAVING THE SITE. PERIMETER CONTROLS SHOULD BE CHECKED DAILY, ADJUSTED, AND/OR REPAIRED TO FULLY CONTAIN AND CONTROL SEDIMENT LADEN RUNOFF FROM LEAVING THE SITE. ACCUMULATED SEDIMENT SHALL BE REMOVED WHEN IT HAS REACHED THE LIMITS OF THE EFFECTIVE CAPACITY OF THE CONTROL, AS NOTED ON THE DETAIL OR PER MANUFACTURER'S RECOMMENDATION, WHICHEVER IS MORE STRINGENT. IN ADDITION, THE CONTRACTOR MAY NEED TO ADJUST OR REPAIR MEASURES IN TIMES OF ADVERSE WEATHER CONDITIONS, OR AS DIRECTED BY THE AGENCY CONSTRUCTION SITE REVIEWER.
9. STRIP TOPSOIL AND PLACE IN TEMPORARY STOCKPILE. STOCKPILE SHALL BE TEMPORARILY STABILIZED.
10. BEGIN DEMOLITION OF CONCRETE PADS, RETAINING WALLS, CONCRETE WALLS AND SITE IMPROVEMENTS DEPICTED ON DEMOLITION PLANS, SHEETS C6 & C7.
11. BEGIN BULK EXCAVATION OF BUILDING PAD AND CONCRETE AREA AND HOME BULL PEN. SPOILS SHALL BE HAULED OFFSITE TO A SITE WITH AN APPROVED EROSION AND SEDIMENT CONTROL PLAN.
12. RELOCATE GAS AND ELECTRIC SERVICES, COORDINATE WITH UTILITY OWNERS.
13. BEGIN BUILDING CONSTRUCTION, BULL PEN CONSTRUCTION, AND ALL RETAINING WALLS.
14. TRENCH PARKING LOT FOR LIGHTING UPGRADES, REPLACE POLES AS NEEDED.
15. INSTALL STORM DRAINAGE AND MBR OUTFALL STRUCTURE. INSTALL INLET PROTECTION IMMEDIATELY.
16. FINE GRADE ALL AREAS AND INSTALL STONE BASE FOR CONCRETE PADS & WALKS VEGETATIVELY STABILIZED ALL PERVIOUS AREAS.
17. INSTALL CONCRETE PADS AND WALKS. CONVERT SIP TO AGIP.
18. PAVE ALL TRENCHED AREAS IN PARKING LOT AND REPLACE ANY DAMAGED CURBING.
19. WITH APPROVAL OF THE E&S INSPECTOR AND MDE, BEGIN CONSTRUCTION OF THE MBR.
20. FLUSH OUT ANY ACCUMULATED SEDIMENT FROM THE STORMWATER PIPES.
21. VEGETATIVELY STABILIZE AREAS TO BE GRASSED.
22. ONCE ALL CONSTRUCTION IS COMPLETE AND WITH PERMISSION OF THE SEDIMENT AND EROSION CONTROL INSPECTOR, REMOVE ALL EROSION AD SEDIMENT CONTROLS.
23. THE TERMINATION OF THE CONSTRUCTION GENERAL PERMIT WILL REQUIRE SUBMISSION AND ACCEPTANCE OF THE POST CONSTRUCTION VERIFICATION CHECKLIST. CHECKLIST TO BE REVIEWED, SIGNED AND SEALED BY A LICENSED PROFESSIONAL.
24. FINAL SITE SURVEY AND AS-BUILT SUBMISSION TO THE MDE SEDIMENT AND STORMWATER PLAN REVIEW DIVISION.

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
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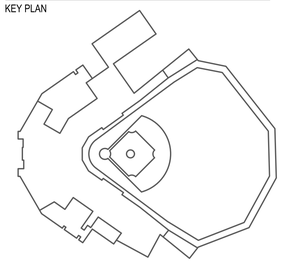
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALSBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024

PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

EROSION & SEDIMENT CONTROL PLAN

PHASE CD

DRAWING NO. C17

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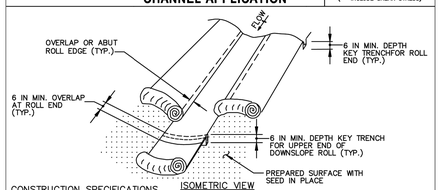
DETAIL B-4-6-A TEMPORARY SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL
TSSMC – * lb/ft² (* INCLUDE SHEAR STRESS)



ISOMETRIC VIEW

CONSTRUCTION SPECIFICATIONS

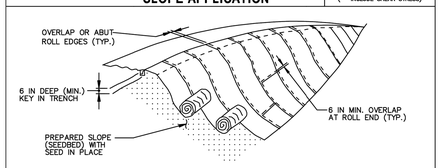
1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN-MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON-LEACHING AND NON-TOXIC TO VEGETATION AND SEED GERMINATION AND NON-INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH-SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTERLINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MAT SMOOTHLY AND FIRMLY ON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. KEY-IN UPSTREAM END OF EACH MAT ROLL BY DIGGING A 6 INCH (MINIMUM) TRENCH AT THE UPSTREAM END OF THE MATTING, PLACING THE ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END.
7. OVERLAP OR ABUT THE ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-4-6-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL
TSSMS – * lb/ft² (* INCLUDE SHEAR STRESS)



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3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH-SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION & SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWNSLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE UPSLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.

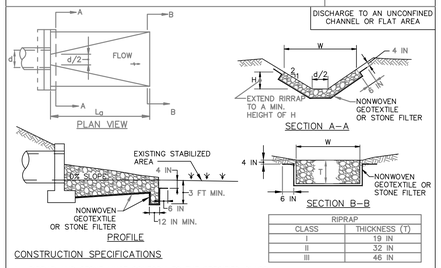
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL D-4-1-C ROCK OUTLET PROTECTION III

STANDARD SYMBOL
ROPIII

DISCHARGE TO AN UNCONFINED CHANNEL OR FLAT AREA



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

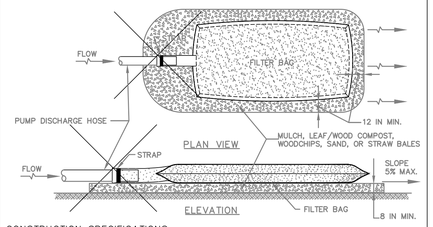
1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (⅜ TO 1½ INCH MINIMUM STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND RIPRAP DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-4 FILTER BAG

STANDARD SYMBOL
☒FB



CONSTRUCTION SPECIFICATIONS

1. TIGHTLY SEAL SLEEVE AROUND THE PUMP DISCHARGE HOSE WITH A STRAP OR SIMILAR DEVICE.
2. PLACE FILTER BAG ON SUITABLE BASE (E.G., MULCH, LEAF/WOOD COMPOST, WOODCHIPS, SAND, OR STRAW BALES) LOCATED ON A LEVEL OR 5% MAXIMUM SLOPING SURFACE. DISCHARGE TO A STABILIZED AREA. EXTEND BASE A MINIMUM OF 12 INCHES FROM EDGES OF BAG.
3. CONTROL PUMPING RATE TO PREVENT EXCESSIVE PRESSURE WITHIN THE FILTER BAG IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS. AS THE BAG FILLS WITH SEDIMENT, REDUCE PUMPING RATE.
4. REMOVE AND PROPERLY DISPOSE OF FILTER BAG UPON COMPLETION OF PUMPING OPERATIONS OR AFTER BAG HAS REACHED CAPACITY, WHICHEVER OCCURS FIRST. SPREAD THE DEWATERED SEDIMENT FROM THE BAG IN AN APPROVED UPLAND AREA AND STABILIZE WITH SEED AND MULCH BY THE END OF THE WORK DAY. RESTORE THE SURFACE AREA BENEATH THE BAG TO ORIGINAL CONDITION UPON REMOVAL OF THE DEVICE.
5. USE NONWOVEN GEOTEXTILE WITH DOUBLE STITCHED SEAMS USING HIGH STRENGTH THREAD. SIZE SLEEVE TO ACCOMMODATE A MAXIMUM 4 INCH DIAMETER PUMP DISCHARGE HOSE. THE BAG MUST BE MANUFACTURED FROM A NONWOVEN GEOTEXTILE THAT MEETS OR EXCEEDS MINIMUM AVERAGE ROLL VALUES (MARV) FOR THE FOLLOWING:

GRAB TENSILE	250 LB	ASTM D-4632
PUNCTURE	150 LB	ASTM D-4833
FLOW RATE	70 GAL/MIN/FT²	ASTM D-4491
PERMITTIVITY (SEC^{-1})	1.2 SEC^{-1}	ASTM D-4491
UV RESISTANCE	70% STRENGTH @ 500 HOURS	ASTM D-4355
APPARENT OPENING SIZE (AOS)	0.15–0.18 MM	ASTM D-4751
SEAM STRENGTH	90%	ASTM D-4632

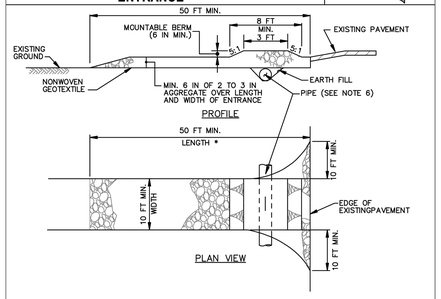
6. REPLACE FILTER BAG IF BAG CLOGS OR HAS RIPS, TEARS, OR PUNCTURES. DURING OPERATION KEEP CONNECTION BETWEEN PUMP HOSE AND FILTER BAG WATER TIGHT. REPLACE BEDDING IF IT BECOMES DISPLACED.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL
SCE



CONSTRUCTION SPECIFICATIONS

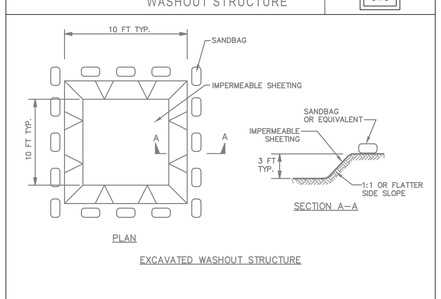
1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*50 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-6 ONSITE CONCRETE WASHOUT STRUCTURE

STANDARD SYMBOL
CWS



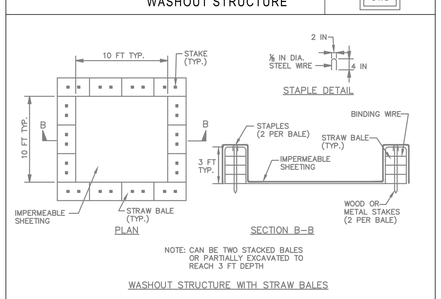
1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL H-6 ONSITE CONCRETE WASHOUT STRUCTURE

STANDARD SYMBOL
CWS



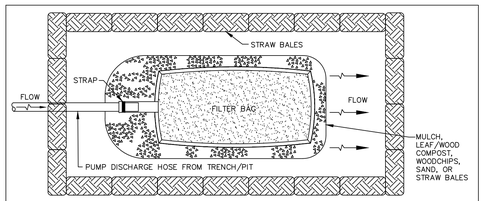
CONSTRUCTION SPECIFICATIONS

1. LOCATE WASHOUT STRUCTURE A MINIMUM OF 50 FEET AWAY FROM OPEN CHANNELS, STORM DRAIN INLETS, SENSITIVE AREAS, WETLANDS, BUFFERS AND WATER COURSES AND AWAY FROM CONSTRUCTION TRAFFIC.
2. SIZE WASHOUT STRUCTURE FOR VOLUME NECESSARY TO CONTAIN WASH WATER AND SOLIDS AND MAINTAIN AT LEAST 4 INCHES OF FREEBOARD. TYPICAL DIMENSIONS ARE 10 FEET X 10 FEET X 3 FEET DEEP.
3. PREPARE SOIL BASE FREE OF ROCKS OR OTHER DEBRIS THAT MAY CAUSE TEARS OR HOLES IN THE LINER. FOR LINER, USE 10 MIL OR THICKER UV RESISTANT, IMPERMEABLE SHEETING, FREE OF HOLES AND TEARS OR OTHER DEFECTS THAT COMPROMISE IMPERMEABILITY OF THE MATERIAL.
4. PROVIDE A SIGN FOR THE WASHOUT IN CLOSE PROXIMITY TO THE FACILITY.
5. KEEP CONCRETE WASHOUT STRUCTURE WATER TIGHT. REPLACE IMPERMEABLE LINER IF DAMAGED (E.G., RIPPED OR PUNCTURED), EMPTY OR REPLACE WASHOUT STRUCTURE THAT IS 75 PERCENT FULL, AND DISPOSE OF ACCUMULATED MATERIAL PROPERLY. DO NOT REUSE PLASTIC LINER. WET-VACUUM STORED LIQUIDS THAT HAVE NOT EVAPORATED AND DISPOSE OF IN AN APPROVED MANNER. PRIOR TO FORECASTED RAINSTORMS, REMOVE LIQUIDS OR COVER STRUCTURE TO PREVENT OVERFLOWS. REMOVE HARDENED SOLIDS, WHOLE OR BROKEN UP, FOR DISPOSAL OR RECYCLING. MAINTAIN RUNOFF DIVERSION AROUND EXCAVATED WASHOUT STRUCTURE UNTIL STRUCTURE IS REMOVED.

2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION



- PORTABLE PUMP MAY BE USED TO DEWATER DRILLING PITS, TRENCHES, AND EXCAVATED AREAS.
- THE END OF THE PUMP DISCHARGE HOSE SHALL HAVE A FILTER BAG ATTACHED TO THE END PER DETAIL F-4 FILTER BAG. FILTER BAG SHALL BE SURROUNDED BY STRAW BALES.
- FILTER BAG LOCATION SHALL NOT BE IMMEDIATELY UPSTREAM OF STEEP SLOPES.
- PERSONNEL SHALL BE ASSIGNED TO MONITOR PUMPING OPERATIONS TO ENSURE THAT SEDIMENT POLLUTION IS ABATED.
- DOWNSTREAM AREA SHALL BE VEGETATIVELY STABILIZED. CONTRACTOR SHALL ENSURE THAT DOWNSTREAM LAND DOES NOT ERODE. IF EROSION OCCURS, IMMEDIATELY CEASE PUMPING, RESTABILIZE DISTURBED LAND, AND RELOCATE FILTER BAG.
- PUMPING SEDIMENT LADEN WATER INTO WATERS OF THE STATE WITHOUT FILTRATION IS STRICTLY FORBIDDEN.
- DEWATERING MUST BE ROUTED THROUGH A FILTER BAG.
- THIS PROJECT IS NOT PERMITTED TO DEWATER 10,000 GALLONS PER DAY OF GROUNDWATER. GROUNDWATER MAY BE DEWATERED CONTINUOUSLY AT A RATE NO GREATER THAN 7 GPM OVER THE ENTIRE 24 HOUR DAY OR NO GREATER THAN 20 GPM FOR AN 8 HOUR WORK DAY.

DEWATERING STRATEGY
N.T.S.

NOTE TO CONTRACTOR:
EROSION/SEDIMENT CONTROL WILL BE STRICTLY ENFORCED

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

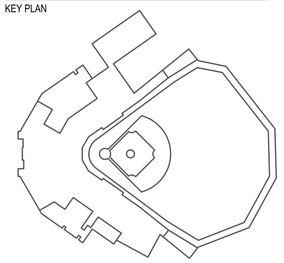
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME

EROSION & SEDIMENT CONTROL DETAILS

PHASE	DRAWING NO.
CD	C18

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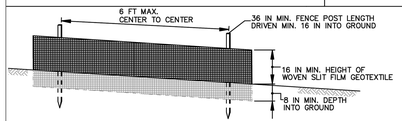
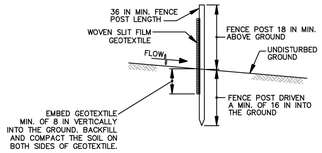
File Path
6/6/2008 9:00:21 AM

DETAIL E-1 SILT FENCE

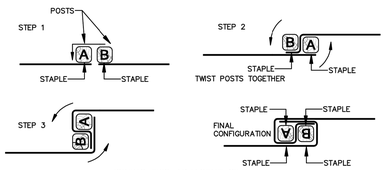
STANDARD SYMBOL: SF



ELEVATION



CROSS SECTION



JOINING TWO ADJACENT SILT FENCE SECTIONS (TOP VIEW)

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-1 SILT FENCE

STANDARD SYMBOL: SF

CONSTRUCTION SPECIFICATIONS

1. USE WOOD POSTS 1¾ X 1¾ ± ⅛ INCH (MINIMUM) SQUARE CUT OF SOUND QUALITY HARDWOOD. AS AN ALTERNATIVE TO WOODEN POST USE STANDARD "T" OR "U" SECTION STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. USE 36 INCH MINIMUM POSTS DRIVEN 16 INCH MINIMUM INTO GROUND NO MORE THAN 6 FEET APART.
3. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS AND FASTEN GEOTEXTILE SECURELY TO UPSLOPE SIDE OF FENCE POSTS WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
4. PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
5. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES VERTICALLY INTO THE GROUND. BACKFILL AND COMPACT THE SOIL ON BOTH SIDES OF FABRIC.
6. WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, TWIST, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL.
7. EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
8. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

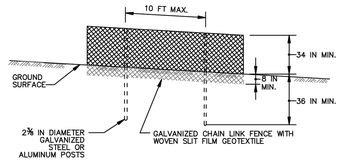
2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

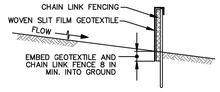
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL: SSF



ELEVATION



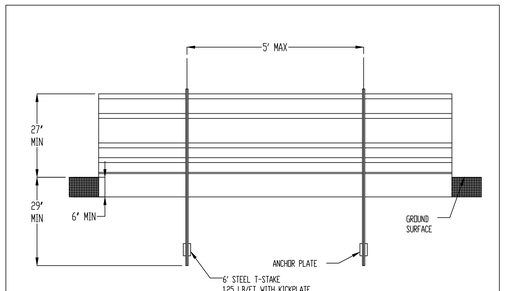
CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. INSTALL 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2⅜ INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HOG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION



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ACF ENVIRONMENTAL — LET'S GET IT DONE

SMARTFENCE42

FOR ADDITIONAL INFORMATION PLEASE CONTACT: ACF ENVIRONMENTAL 2800 CARTWELL ROAD RICHMOND VA, 800-448-3636, WWW.ACFENVIRONMENTAL.COM

DWG #	REV	DATE
SMARTFENCE42	2	5/14/19
SCALE: DNS	PAGE: 1 OF 1	A

SMARTFENCE 42 MAY BE USED AS ALTERNATIVE TO SILT FENCE

SMARTFENCE 42" INSTALLATION INSTRUCTIONS

STEP 1: EXCAVATE TRENCH
Excavate trench a maximum of 4" wide and 6" deep. The trench shall be hand-cleaned following excavation to remove bulky debris such as rocks, sticks, and soil clods.

STEP 2: PREPARE FENCE
Lay SMARTfence 42 out on the ground along the proposed fence line and next to the anchor trench. Reference NOTE ONE prior to beginning.

STEP 3: INSTALL INITIAL POST

3A) For the initial post, place the end of SMARTfence 42 along the post height and rotate the post 360 degrees, maintaining tension on the Secure the fence to the post at all four (4) orange-colored band locations with steel wire or nylon ties as per NOTE TWO.

3B) Drive the initial post (72" metal t-post) with the attached fence to a depth of 36" below surface.

STEP 4: INSTALL INTERIOR POSTS
Using spacing no greater than 6' on center, drive interior posts to 36" depth below surface and attach the fencing as you go (see NOTE ONE and SMARTfence detail on page 2).

To attach fencing, position SMARTfence 42 in front of the adjacent t-post, pulling the fencing tight and fasten it to the post at all four (4) orange-colored band locations (as per NOTE TWO). It is critical that SMARTfence 42 is pulled tight prior to attaching it to each interior post.

STEP 5: INSTALL FINAL POST
After the interior posts have been fastened, secure the fence to the final post by pulling the final section of fencing taut, and then rotating the post 360 degrees while maintaining tension on the fence Secure the fence to the post at all four (4) orange-colored band locations with the steel wire or nylon ties as per NOTE TWO. Drive the final post into the ground to a 36" depth below the surface.

STEP 6: BACKFILL TRENCH
Ensure bottom 6" of fabric has been placed in trench. Backfill trench (over56) with soil placed around fabric. Compact soil backfill manually or via mechanical equipment such as the front wheel of a tractor, skid steer, roller, or other device (per Note 5 of ASTM D 6462 Standard Practice for Silt Fence Installation).

**Be careful not to damage the fabric during compaction (damaged fabric will not be replaced).

NOTE ONE - INSTALL SPECIFICATIONS:

SMARTfence 42 shall be installed using a 6' (72") metal t-post, 1.25 lbs per foot with a kick plate embedded 3' (36") deep on no more than 6' (72") centers (see detail on page 2.)

NOTE TWO - SUPPLIES FOR ATTACHING FENCING:

To fasten SMARTfence 42 to studded, metal T-posts, use one of following methods:

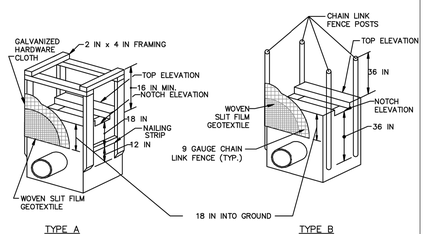
1. Steel wire: Wire-attach SMARTfence 42 to metal T-posts using 16-gage 304 SS wire with mitered ends, securing with safety pliers.
2. Nylon ties: Puncture two 0.25" openings, spaced at a width apart that is roughly equivalent to the post width, and secure the fence to the post using 8" nylon heavy-duty cable ties (zip-ties) that are UV resistant and have a minimum 120-lb tensile strength.

Please contact 800-448-3636 or info@acfenv.com with any questions regarding the installation process.

DETAIL E-9-1 STANDARD INLET PROTECTION

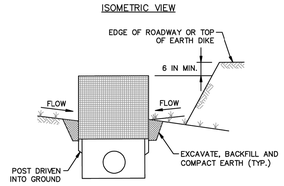
STANDARD SYMBOL: SIP

TYPE A MAXIMUM DRAINAGE AREA = ¼ ACRE
TYPE B MAXIMUM DRAINAGE AREA = 1 ACRE



TYPE A TYPE B

ISOMETRIC VIEW



SECTION FOR TYPE A AND B

1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-9-1 STANDARD INLET PROTECTION

STANDARD SYMBOL: SIP

CONSTRUCTION SPECIFICATIONS

1. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS.
2. EXCAVATE COMPLETELY AROUND THE INLET TO A DEPTH OF 18 INCHES BELOW THE NOTCH ELEVATION.
3. FOR TYPE A, USE NOMINAL 2 INCH X 4 INCH CONSTRUCTION GRADE LUMBER POSTS, DRIVEN 1 FOOT INTO THE GROUND AT EACH CORNER OF THE INLET. PLACE NAIL STRIPS BETWEEN THE POSTS ON THE ENDS OF THE INLET. ASSEMBLE THE TOP PORTION OF THE 2X4 FRAME AS SHOWN. STRETCH ½ INCH GALVANIZED HARDWARE CLOTH TIGHTLY AROUND THE FRAME AND FASTEN SECURELY. FASTEN GEOTEXTILE SECURELY TO THE HARDWARE CLOTH WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND HARDWARE CLOTH A MINIMUM OF 18 INCHES BELOW THE WEIR CREST. THE ENDS OF THE GEOTEXTILE MUST MEET AT A POST, BE OVERLAPPED AND FOLDED, THEN FASTENED TO THE POST.

   FOR TYPE B, USE 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND 6 FOOT LENGTH, DRIVEN A MINIMUM OF 36 INCHES BELOW THE WEIR CREST AT EACH CORNER OF THE STRUCTURE. FASTEN 9 GAUGE OR HEAVIER CHAIN LINK FENCE, 42 INCHES IN HEIGHT, SECURELY TO THE FENCE POSTS WITH WIRE TIES. FASTEN GEOTEXTILE SECURELY TO THE CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 18 INCHES BELOW THE WEIR CREST.
4. BACKFILL AROUND THE INLET IN LOOSE 4 INCH LIFTS AND COMPACT UNTIL SOIL IS LEVEL WITH THE NOTCH ELEVATION ON THE ENDS AND TOP ELEVATION ON THE SIDES.
5. STORM DRAIN INLET PROTECTION REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AFTER EACH RAIN EVENT TO MAINTAIN FUNCTION AND AVOID PREMATURE CLOGGING. IF INLET PROTECTION DOES NOT COMPLETELY DRAIN WITHIN 24 HOURS AFTER A STORM EVENT, IT IS CLOGGED. WHEN THIS OCCURS, REMOVE ACCUMULATED SEDIMENT AND CLEAN, OR REPLACE GEOTEXTILE AND STONE.

2 OF 2

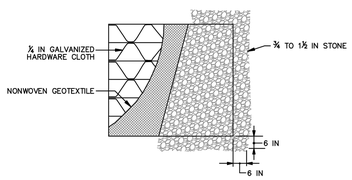
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

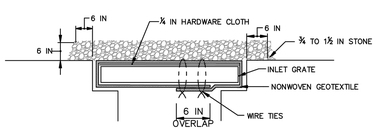
DETAIL E-9-2 AT-GRADE INLET PROTECTION

STANDARD SYMBOL: AGIP

MAXIMUM DRAINAGE AREA = 1 ACRE



PLAN / CUT AWAY VIEW



CROSS SECTION

CONSTRUCTION SPECIFICATIONS

1. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS.
2. LIFT GRATE AND WRAP WITH NONWOVEN GEOTEXTILE TO COMPLETELY COVER ALL OPENINGS. SECURE WITH WIRE TIES AND SET GRATE BACK IN PLACE.
3. PLACE CLEAN ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE 6 INCHES THICK ON THE GRATE.
4. STORM DRAIN INLET PROTECTION REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT AFTER EACH RAIN EVENT TO MAINTAIN FUNCTION AND AVOID PREMATURE CLOGGING. IF INLET PROTECTION DOES NOT COMPLETELY DRAIN WITHIN 24 HOURS AFTER A STORM EVENT, IT IS CLOGGED. WHEN THIS OCCURS, REMOVE ACCUMULATED SEDIMENT AND CLEAN, OR REPLACE GEOTEXTILE AND STONE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

NOTE TO CONTRACTOR:
EROSION/SEDIMENT CONTROL WILL BE STRICTLY ENFORCED

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

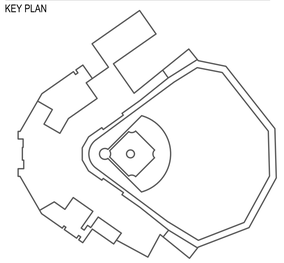
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY TW DATE 6/15/2024

PROJECT NO. D2230059 SCALE NONE

DRAWING NAME

EROSION & SEDIMENT CONTROL DETAILS

PHASE: CD

DRAWING NO.: C19

Q:\2023\D2230059 - Arthur W. Perdue Stadium\dwg\Plot Files\C15 - E&S DETAILS.dwg, 6/17/2024 2:37:46 PM, jbaldeson
File Path
8/5/2008 9:00:21 AM

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B-4 STANDARDS AND SPECIFICATIONS FOR VEGETATIVE STABILIZATION

Definition

Using vegetation as cover to protect exposed soil from erosion.

Purpose

To promote the establishment of vegetation on exposed soil.

Conditions Where Practice Applies

On all disturbed areas not stabilized by other methods. This specification is divided into sections on incremental stabilization; soil preparation, soil amendments and topsoiling; seeding and mulching; temporary stabilization; and permanent stabilization.

Effects on Water Quality and Quantity

Stabilization practices are used to promote the establishment of vegetation on exposed soil.When soil is stabilized with vegetation, the soil is less likely to erode and more likely to allow infiltration of rainfall, thereby reducing sediment loads and runoff to downstream areas.

Planting vegetation in disturbed areas will have an effect on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, percolation, and groundwater recharge. Over time, vegetation will increase organic matter content and improve the water holding capacity of the soil and subsequent plant growth.

Vegetation will help reduce the movement of sediment, nutrients, and other chemicals carried by runoff to receiving waters. Plants will also help protect groundwater supplies by assimilating those substances present within the root zone.

Sediment control practices must remain in place during grading, seedbed preparation, seeding, mulching, and vegetative establishment.

Adequate Vegetative Establishment

Inspect seeded areas for vegetative establishment and make necessary repairs, replacements, and reseedings within the planting season.

1. Adequate vegetative stabilization requires 95 percent groundcover.
2. If an area has less than 40 percent groundcover, restabilize following the original recommendations for lime, fertilizer, seedbed preparation, and seeding.
3. If an area has between 40 and 94 percent groundcover, over-seed and fertilize using half of the rates originally specified.
4. Maintenance fertilizer rates for permanent seeding are shown in Table B.6.

B-4-1 STANDARDS AND SPECIFICATIONS FOR INCREMENTAL STABILIZATION

Definition

Establishment of vegetative cover on cut and fill slopes.

Purpose

To provide timely vegetative cover on cut and fill slopes as work progresses.

Conditions Where Practice Applies

Any cut or fill slope greater than 15 feet in height. This practice also applies to stockpiles.

Criteria

A. Incremental Stabilization - Cut Slopes
1. Excavate and stabilize cut slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all cut slopes as the work progresses.
2. Construction sequence example (Refer to Figure B.1):
   a. Construct and stabilize all temporary swales or dikes that will be used to convey runoff around the excavation.
   b. Perform Phase 1 excavation, prepare seedbed, and stabilize.
   c. Perform Phase 2 excavation, prepare seedbed, and stabilize. Overseed Phase 1 areas as necessary.
   d. Perform final phase excavation, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once excavation has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

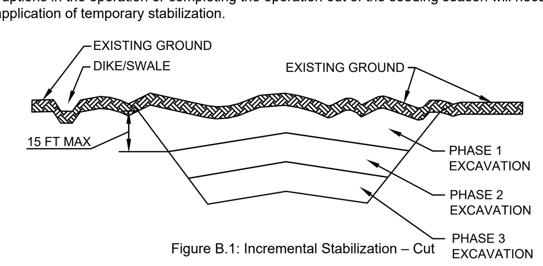


Figure B.1: Incremental Stabilization – Cut

B. Incremental Stabilization - Fill Slopes
1. Construct and stabilize fill slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all slopes as the work progresses.
2. Stabilize slopes immediately when the vertical height of a lift reaches 15 feet, or when the grading operation ceases as prescribed in the plans.
3. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
4. Construction sequence example (Refer to Figure B.2):
   a. Construct and stabilize all temporary swales or dikes that will be used to divert runoff around the fill. Construct silt fence on low side of fill unless other methods shown on the plans address this area.
   b. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
   c. Place Phase 1 fill, prepare seedbed, and stabilize.
   d. Place Phase 2 fill, prepare seedbed, and stabilize.
   e. Place final phase fill, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once the placement of fill has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

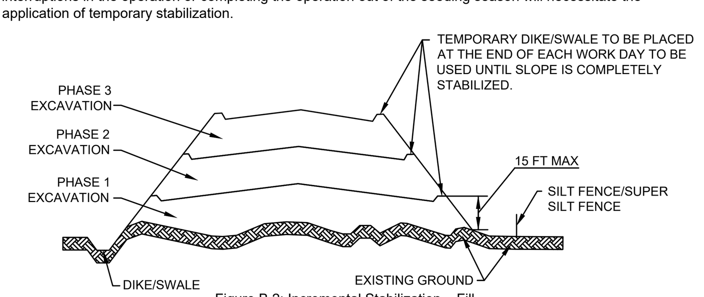


Figure B.2: Incremental Stabilization – Fill

B-4-2 STANDARDS AND SPECIFICATIONS FOR SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS

Definition

The process of preparing the soils to sustain adequate vegetative stabilization.

Purpose

To provide a suitable soil medium for vegetative growth.

Conditions Where Practice Applies

Where vegetative stabilization is to be established.

Criteria

A. Soil Preparation
1. Temporary Stabilization
   a. Seedbed preparation consists of loosening soil to a depth of 3 to 5 inches by means of suitable agricultural or construction equipment, such as disc harrows or chisel plows or rippers mounted on construction equipment. After the soil is loosened, it must not be rolled or dragged smooth but left in the roughened condition. Slopes 3:1 or flatter are to be tracked with ridges running parallel to the contour of the slope.
   b. Apply fertilizer and lime as prescribed on the plans.
   c. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.
2. Permanent Stabilization
   a. A soil test is required for any earth disturbance of 5 acres or more. The minimum soil conditions required for permanent vegetative establishment are:
      i. Soil pH between 6.0 and 7.0.
      ii. Soluble salts less than 500 parts per million (ppm).
      iii. Soil contains less than 40 percent clay but enough fine grained material (greater than 30 percent silt plus clay) to provide the capacity to hold a moderate amount of moisture. An exception: if lovegrass will be planted, then a sandy soil (less than 30 percent silt plus clay) would be acceptable.
      iv. Soil contains 1.5 percent minimum organic matter by weight.
      v. Soil contains sufficient pore space to permit adequate root penetration.

2

   b. Application of amendments or topsoil is required if on-site soils do not meet the above conditions.
   c. Graded areas must be maintained in a true and even grade as specified on the approved plan, then scarified or otherwise loosened to a depth of 3 to 5 inches.
   d. Apply soil amendments as specified on the approved plan or as indicated by the results of a soil test.
   e. Mix soil amendments into the top 3 to 5 inches of soil by disking or other suitable means. Rake lawn areas to smooth the surface, remove large objects like stones and branches, and ready the area for seed application. Loosen surface soil by dragging with a heavy chain or other equipment to roughen the surface where site conditions will not permit normal seedbed preparation. Track slopes 3:1 or flatter with tracked equipment leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. Leave the top 1 to 3 inches of soil loose and friable. Seedbed loosening may be unnecessary on newly disturbed areas.

B. Topsoiling
1. Topsoil is placed over prepared subsoil prior to establishment of permanent vegetation. The purpose is to provide a suitable soil medium for vegetative growth. Soils of concern have low moisture content, low nutrient levels, low pH, materials toxic to plants, and/or unacceptable soil gradation.
2. Topsoil salvaged from an existing site may be used provided it meets the standards as set forth in these specifications. Typically, the depth of topsoil to be salvaged for a given soil type can be found in the representative soil profile section in the Soil Survey published by USDA-NRCS.
3. Topsoiling is limited to areas having 2:1 or flatter slopes where:
   a. The texture of the exposed subsoil/parent material is not adequate to produce vegetative growth.
   b. The soil material is so shallow that the rooting zone is not deep enough to support plants or furnish continuing supplies of moisture and plant nutrients.
   c. The original soil to be vegetated contains material toxic to plant growth.
   d. The soil is so acidic that treatment with limestone is not feasible.
4. Areas having slopes steeper than 2:1 require special consideration and design.
5. Topsoil Specifications: Soil to be used as topsoil must meet the following criteria:
   a. Topsoil must be a loam, sandy loam, clay loam, silt loam, sandy clay loam, or loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by the appropriate approval authority. Topsoil must not be a mixture of contrasting textured subsoils and must contain less than 5 percent by volume of cinders, stones, slag, coarse fragments, gravel, sticks, roots, trash, or other materials larger than 1½ inches in diameter.
   b. Topsoil must be free of noxious plants or plant parts such as Bermuda grass, quack grass, Johnson grass, nut sedge, poison ivy, thistle, or others as specified.
   c. Topsoil substitutes or amendments, as recommended by a qualified agronomist or soil scientist and approved by the appropriate approval authority, may be used in lieu of natural topsoil.
6. Topsoil Application
   a. Erosion and sediment control practices must be maintained when applying topsoil.
   b. Uniformly distribute topsoil in a 5 to 8 inch layer and lightly compact to a minimum thickness of 4 inches. Spreading is to be performed in such a manner that sodding or seeding can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations must be corrected in order to prevent the formation of depressions or water pockets.
   c. Topsoil must not be placed if the topsoil or subsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading B.14and seedbed preparation.

C. Soil Amendments (Fertilizer and Lime Specifications)
1. Soil tests must be performed to determine the exact ratios and application rates for both lime and fertilizer on sites having disturbed areas of 5 acres or more. Soil analysis may be performed by a recognized private or commercial laboratory. Soil samples taken for engineering purposes may also be used for chemical analyses.
2. Fertilizers must be uniform in composition, free flowing and suitable for accurate application by appropriate equipment. Manure may be substituted for fertilizer with prior approval from the appropriate approval authority. Fertilizers must all be delivered to the site fully labeled according to the applicable laws and must bear the name, trade name or trademark and warranty of the producer.
3. Lime materials must be ground limestone (hydrated or burnt lime may be substituted except when hydroseeding) which contains at least 50 percent total oxides (calcium oxide plus magnesium oxide). Limestone must be ground to such fineness that at least 50 percent will pass through a #100 mesh sieve and 98 to 100 percent will pass through a #20 mesh sieve.
4. Lime and fertilizer are to be evenly distributed and incorporated into the top 3 to 5 inches of soil by disking or other suitable means.
5. Where the subsoil is either highly acidic or composed of heavy clays, spread ground limestone at the rate of 4 to 8 tons/acre (200-400 pounds per 1,000 square feet) prior to the placement of topsoil.

B-4-3 STANDARDS AND SPECIFICATIONS FOR SEEDING AND MULCHING

Definition

The application of seed and mulch to establish vegetative cover.

Purpose

To protect disturbed soils from erosion during and at the end of construction.

Conditions Where Practice Applies

To the surface of all perimeter controls, slopes, and any disturbed area not under active grading.

Criteria

A. Seeding
1. Specifications
   a. All seed must meet the requirements of the Maryland State Seed Law. All seed shall be subject to retesting by a recognized seed laboratory. All seed used shall have been tested within the 6 months immediately preceding the date of sowing such material on any project. Refer to Table B.4 regarding the quality of seed. Seed tags shall be made available upon request to the inspector to verify type of seed and seeding rate.
   b. Mulch alone may be applied between the fall and spring seeding dates only if the ground is frozen. The appropriate seeding mixture must be applied when the ground thaws.
   c. Inoculants: The inoculant for treating legume seed in the seed mixtures must be a pure culture of nitrogen fixing bacteria prepared specifically for the species. Inoculants must not be used later than the date indicated on the container. Add fresh inoculants as directed on the package. Use four times the recommended rate when hydroseeding. Note: It is very important to keep inoculant as cool as possible until used. Temperatures above 75 to 80 degrees Fahrenheit can weaken bacteria and make the inoculant less effective.
   d. Sod or seed must not be placed on soil which has been treated with soil sterilants or chemical used for weed control until sufficient time has elapsed (14 days min.) to permit dissipation of phyto-toxic materials.
2. Application
   a. Dry Seeding: This includes use of conventional drop or broadcast spreaders.
      i. Incorporate seed into the subsoil at the rates prescribed on Temporary Seeding Table B.1, Permanent Seeding Table B.3, or site-specific seeding summaries.
      ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction. Roll the seeded area with a weighted roller to provide good seed to soil contact.
   b. Drill or Cultipacker Seeding: Mechanized seeders that apply and cover seed with soil.
      i. Cultipacking seeders are required to bury the seed in such a fashion as to provide at lease 1/4 inch of soil covering. Seedbed must be firm after planting.
      ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction.
   c. Hydroseeding: Apply seed uniformly with hydroseeder (slurry includes seed and fertilizer).
      i. If fertilizer is being applied at the time of seeding, the application rates should not exceed the following: nitrogen, 100 pounds per acre total of soluble nitrogen; P2O3 (phosphorous), 200 pounds per acre; k20 (potassium), 200 pounds per acre.
      ii. Lime: Use only ground agricultural limestone (up to 3 tones per acre may be applied by hydroseeding). Normally, not more than 2 tons are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.
      iii. Mix seed and fertilizer on site and seed immediately and without interruption.
      iv. When hydroseeding do not incorporate seed into the soil.

B. Mulching
1. Mulch Materials (in order of preference)
   a. Straw consisting of thoroughly threshed wheat, rye, oat, or barley and reasonably bright in color. Straw is to be free of noxious weed seeds and specified in the Maryland Seed Law and not musty, moldy, caked, decayed, or excessively dusty. Not: Use only sterile straw mulch in areas where one species of grass is desired.
   b. Wood Cellulose Fiber Mulch (WCFM) consisting of specially prepared wood cellulose processed into a uniform fibrous physical state.
      i. WCFM is to be dyed green or contain a green dye in the package that will provide and appropriate color to facilitate visual inspection of the uniformly spread slurry.
      ii. WCFM, including dye, must contain no germination or growth inhibiting factors.
      iii. WCFM material are to be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material must form a botter-like ground cover, on application, having moisture absorption and percolation properties and must cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
      iv. WCFM material must not contain elements or compounds at concentration levels that will be phyto-toxic.
      v. WCFM must conform to the following physical requirements: fiber length of approximately 10 millimeters, diameter approximately 1 millimeter, pH range of 4.0 to 8.5, ash content of 1.6 percent maximum and water holding capacity of 90 percent minimum.

2. Application
   a. Apply mulch to all seeded areas immediately after seeding.
   b. When straw mulch is used, spread it over all seeded areas at the rate of 2 tons per acre to a uniform loose depth of 1 to 2 inches. Apply mulch to achieve a uniform distribution and depth so that the soil surface is not exposed. When using a mulch anchoring tool, increase the application rate to 2.5 tons per acre.
   c. Wood cellulose fiber used as mulch must be applied at a net dry weight of 1500 pounds per acre. Mix the wood cellulose fiber with water to attain a mixture with a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.

3. Anchoring
   a. Perform mulch anchoring immediately following application of mulch to minimize loss by wind or water. This may be done by one of the following methods (listed by preference), depending upon the size of the area and erosion hazard:
      i. A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of 2 inches. This practice is most effective on large areas, but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should follow the contour.
      ii. Wood cellulose fiber may be used for anchoring straw. Apply the fiber binder at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
      iii. Synthetic binders such as Acrylic DLR (Agro-Tack), DCA-70, Petroact, Terra Tax II, Terra Tack AR or other approved equal may be used. Follow application rate as specified by the manufacturer. Application of liquid binders needs to be heavier at the edges where wind catches mulch, such as in valleys and on crests of banks. Use of asphalt binders is strictly prohibited.
      iv. Lightweight plastic netting may be stapled over the mulch according to manufacturer recommendations. Netting is usually available in rolls 4 to 15 feet wide and 300 to 3,000 feet long.

Table B.2: Recommended Permanent Seeding Mixtures by Site Condition or Purpose

Site Condition or Purpose of the Planting	Recommended Mix (see Table B.3)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Steep Slopes, Roadsides	R	R	R	A	R	A				A	A	R	R
Sand and Gravel Pits, Sanitary Landfills	R	R	R	A	R	A				A	A	R	
Salt-Damaged Areas	A												R
Mine Spoil, Dredged Material, and Spoil Banks	A		R	A	A								
Utility Rights-of-Way	R	R	R	R	R	R	A			R	R	R	
Dikes and Dams	A	A	R	A		R	R	A		R	R	R	
Berms and Low Embankments (not on Ponds)	R	R	R	R	R	R	A	A		R	R	R	A
Pond and Channel Banks, Streambanks	R	R	R	R	A	A	A			A	A		
Grassed Waterways, Diversions, Terraces, Spillways	A		A	R	R	A	R				R		A
Bottom of Drainage Channels, Swales, Detention Basins				A		R	A			A	R		R
Field Borders, Filter Strips, Contour Buffer Strips	R	R	R	A	A	R	A	R	R	R	R	R	A
Wastewater Treatment Strips and Areas								R	A	A			
Heavy Use Areas (Grass Loafing Paddocks for Livestock)							R						
Athletic Fields, Residential and Commercial Lawns						A	R	R		R			
Recreation Areas						R	R	R		R			

R = Recommended mix for this site condition or purpose.

A = Alternative mix, depending on site conditions.

STOCKPILE STABILIZATION NOTES:

1. STOCKPILES MUST BE STABILIZED IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION REQUIREMENT AS WELL AS STANDARD B-4-1 INCREMENTAL STABILIZATION AND STANDARD B-4-4 TEMPORARY STABILIZATION.

2. THE STOCKPILE AREA MUST CONTINUOUSLY MEET THE REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION. SIDE SLOPES MUST BE MAINTAINED AT NO STEEPER THAN A 2:1 RATIO. THE STOCKPILE AREA MUST BE KEPT FREE OF EROSION.

Note below taken from the *Delaware Erosion & Sediment Control Handbook*, Construction Site Waste Management & Spill Control, DE-ESC-3.6.1 sheets 1 through 5.

Pollution Prevention – Spill Prevention
1. Fueling should only take place in signed designated areas, away from downstream drainage facilities and watercourses.
2. Fueling must be with nozzles equipped with automatic shut-off to control drips. Do not top off.
3. Protect the areas where equipment or vehicles are being repaired, maintained, fueled or parked from storm water run-on and runoff.
4. Use barriers such as berms to prevent storm water run-on and runoff, and to contain spills.
5. Place a "Fueling Area" sign next to each fueling area.
6. Store hazardous materials such as fuel, solvents, oil and chemicals in secondary containment.
7. Inspect vehicles and equipment for leaks on each day of use. Repair fluid and oil leaks immediately.
8. Absorbent spill clean-up materials and spill kits must be available in fueling areas and on fuel trucks.
9. If fueling is to take place at night, make sure the fueling area is sufficiently illuminated.
10. Properly dispose of used oil, fluids, lubricants and spill clean-up materials.

CLEAN UP SPILLS
1. If it is safe to do so, immediately contain and clean up any chemical and/or hazardous material spills.
2. Properly dispose of used oil, fluids, lubricants and spill clean-up materials.
3. Do not bury spills or wash them down with water.

LEAKS AND DRIPS
1. Use drip pans or absorbent pads at all times. Place under and around leaky equipment.
2. Do not allow oil, grease, fuel or chemicals to drip onto the ground.
3. Have spill kits and clean up material on-site.
4. Repair leaky equipment promptly or remove problem vehicles and equipment from the site. Clean up contaminated soil immediately.
5. Store contaminated waste in sealed containers constructed of suitable material. Label these containers properly.
6. Clean up all spills and leaks. Promptly dispose of waste and spent clean up materials.

Notes:
The Construction Site Pollution Prevention Plan should include the following elements:

1. Material Inventory
Document the storage and use of the following materials:
a. Concrete
b. Detergents
c. Paints (enamel and latex)
d. Cleaning solvents
e. Pesticides
f. Wood scraps
g. Fertilizers
h. Petroleum based products

2. Good housekeeping practices
a. Store only enough product required to do the job.
b. All materials shall be stored in a neat, orderly manner in their original labeled containers and covered.
c. Substances shall not be mixed.
d. When possible, all of a product shall be used up prior to disposal of the container.
e. Manufacturers' instructions for disposal shall be strictly adhered to.
f. The site foreman shall designate someone to inspect all BMPs daily.

3. Waste management practices
a. All waste materials shall be collected and stored in securely lidded dumpsters in a location that does not drain to a waterbody.
b. Waste materials shall be salvaged and/or recycled whenever possible.
c. The dumpsters shall be emptied a minimum of twice per week, or more if necessary. The licensed trash hauler is responsible for cleaning out dumpsters.
d. Trash shall be disposed of in accordance with all applicable Delaware laws.
e. Trash cans shall be placed at all lunch spots and littering is strictly prohibited. Recycle bins shall be placed near the construction trailer.
f. If fertilizer bags can not be stored in a weather-proof location, they shall be kept on a pallet and covered with plastic sheeting which is overlapped and anchored.

4. Equipment maintenance practices
a. If possible, equipment should be taken to off-site commercial facilities for washing and maintenance.
b. If performed on-site, vehicles shall be washed with high-pressure water spray without detergents in an area contained by an impervious berm.
c. Drip pans shall be used for all equipment maintenance.
d. Equipment shall be inspected for leaks on a daily basis.
e. Washout from concrete trucks shall be disposed of in a temporary pit for hardening and proper disposal.
f. Fuel nozzles shall be equipped with automatic shut-off valves.
g. All used products such as oil, antifreeze, solvents and tires shall be disposed of in accordance with manufacturers' recommendations and local, state and federal laws and regulations.

5. Spill prevention practices
a. Potential spill areas shall be identified and contained in covered areas with no connection to the storm drain system.
b. Warning signs shall be posted in hazardous material storage areas.
c. Preventive maintenance shall be performed on all tanks, valves, pumps, pipes and other equipment as necessary.
d. Low or non-toxic substances shall be prioritized for use.
e. Contact information for reporting spills through the DNREC 24-Hour Toll Free Number shall be prominently posted.

6. Education
a. Best management practices for construction site pollution control shall be a part of regular progress meetings.
b. Information regarding waste management, equipment maintenance and spill prevention shall be prominently posted in the construction trailer.

CONTACT INFORMATION

MDE	8 am - 5 pm	410-537-3510
	After hours	866-633-4686
National Response Center		800-424-8802

1. CONTRACTOR TO INSTALL SOIL EROSION AND SEDIMENT CONTROL DEVICES PRIOR TO ANY GRADING. FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1) AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE.
2. ALL TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES ARE TO BE PROVIDED AS INDICATED ON THIS PLAN, WITH LOCATION ADJUSTMENTS TO BE MADE IN THE FIELD AS NECESSARY. AND TO BE MAINTAINED AT THE END OF EACH WORKING DAY UNTIL PROJECT COMPLETION. THE MINIMUM AREA PRACTICAL SHALL BE DISTURBED FOR THE MINIMUM AMOUNT OF TIME POSSIBLE.
3. CLEARING AND GRUBBING SHALL INCLUDE ALL TREES, BRUSH, DEBRIS, ROOT MAT AND ORGANIC MATERIAL TO BE REMOVED.
4. TEMPORARY SEEDING SHALL BE ACCOMPLISHED BETWEEN FEBRUARY 1st THROUGH APRIL 30th OR AUGUST 15th THROUGH NOVEMBER 1st DURING OTHER TIMES, TEMPORARY MULCHING SHALL BE PROVIDED.
5. TEMPORARY SEEDING SHALL CONFORM TO THE FOLLOWING APPLICATIONS: 600 LBS. PER ACRE OF 10-10-10; 4000 LBS. PER ACRE OF GROUND LIMESTONE, TO BE INCORPORATED INTO THE SOIL BY DISKING OR OTHER SUITABLE MEANS. ANNUAL RYE GRASS SHALL BE APPLIED AT A RATE OF 50 LBS. PER ACRE USING SUITABLE EQUIPMENT. MULCHING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER SEEDING.

HARDINESS ZONE (FROM FIGURE B.3): 6B SEED MIXTURE (FROM TABLE B.1):					FERTILIZER RATE (10-20-10)	LIME RATE
NO.	SPECIES	APPLICATION RATE (lb./ac.)	SEEDING DATES	SEEDING DEPTHS		
1	CEREAL RYE	112	2/15-4/30 8/15-12/15	1"	436 lb./ac. (10 lb/1000 s.f.)	2 tons/ac. (90 lb./1000 s.f.)
2	FOXTAIL MILLET	30	5/1-8/14	1/2"		

6. MULCHING SHALL BE UNCHOPPED, UNROTTED, SMALL GRAIN STRAW APPLIED AT A RATE OF 2-2 1/2 TONS PER ACRE. ANCHOR MULCHING WITH A MULCH ANCHORING TOOL ON THE CONTOUR, OR WITH WOOD CELLULOSE FIBER AT 750 LBS. PER ACRE NET DRY WEIGHT OR 50 LBS. OF WOOD CELLULOSE FIBER PER 100 GALS. OF WATER, OR WITH A SYNTHETIC LIQUID BINDER ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
7. PERMANENT SEEDING SHALL BE ACCOMPLISHED BETWEEN MARCH 1st AND MAY 15th, OR AUGUST 15th THROUGH NOVEMBER 15th. PERMANENT SEEDING AT OTHER THAN SPECIFIED TIMES WILL BE ALLOWED ONLY UPON WRITTEN APPROVAL. PERMANENT SEEDING SHALL CONFORM TO THE FOLLOWING APPLICATIONS: PERMANENT SEEDING FOR SITES HAVING DISTURBED OVER FIVE (5) ACRES SHALL USE FERTILIZER RATES RECOMMENDED BY A SOIL TESTING AGENCY AND THE RECOMMENDATIONS PROVIDED IN THE PERMANENT SEEDING SUMMARY TABLE. PERMANENT SEEDING CONDITIONS OTHER THAN LISTED ABOVE SHALL BE PERFORMED AT THE RATES AND DATES AS PROVIDED IN THE PERMANENT SEEDING SUMMARY TABLE BELOW. FERTILIZER AND LIME AMENDMENTS SHALL BE INCORPORATED INTO THE TOP 3"-5" OF THE SOIL BY DISKING OR OTHER SUITABLE MEANS. MULCHING SHALL BE ACCOMPLISHED AS DISCUSSED IN ITEM #6 OF THESE SPECIFICATIONS.

HARDINESS ZONE (FROM FIGURE B.3): 6B SEED MIXTURE (FROM TABLE B.3):						FERTILIZER RATE (10-20-20)			LIME RATE	REMARKS
NO.	SPECIES	SEEDING RATE (lb/ac)	SEEDING RATE (lb/1,000 SF)	SEEDING DATES	SEEDING DEPTHS	N	P_2O_5	K_2O		
11	CREEPING RED FESCUE	30	0.69	2/1-4/30	1/4"-1/2"	45 lb./ac. (1.0 lb./ 1000 s.f.)	90 lb./ac. (2 lb./ 1000 s.f.)	90 lb./ac. (2 lb./ 1000 s.f.)	2 tons/ac. (90 lb/ 1000 s.f.)	• USED IN ALL AREAS ASSOCIATED WITH DRAINAGE (SWALES, SUBMERGED GRAVEL WETLANDS, FOREBAY)
	CHEWINGS FESCUE	30	0.69	8/5-10/31	1/4"-1/2"					
	KENTUCKY BLUEGRASS	20	0.46	11/1-11/30						
	OPTIONAL ADDITION				1/4"-1/2"					
	ROUGH BLUEGRASS	15	0.34		1/4"-1/2"					
12	CREEPING RED FESCUE	25	0.57	2/1-4/30	1/4"-1/2"	45 lb./ac. (1.0 lb./ 1000 s.f.)	90 lb./ac. (2 lb./ 1000 s.f.)	90 lb./ac. (2 lb./ 1000 s.f.)	2 tons/ac. (90 lb/ 1000 s.f.)	• USED IN ALL NON-DRAINAGE AREAS • ATTRACTIVE MIX OF FINE FESCUES AND WILDFLOWERS FOR LOW MAINTENANCE CONDITIONS. ONCE WELL-ESTABLISHED, THE GRASSES MAY TEND TO OUTCOMPETE THE WILDFLOWERS. • WILDFLOWERS ARE BEST ESTABLISHED BY BROADCASTING AND CULTIPACKING ON A PREPARED SEEDBED. DRILLING CAN BE ALSO USED, BUT CARE MUST BE TAKEN SO THAT SEEDS ARE NOT DRILLED TOO DEEP. • HYDROSEEDING IS NOT RECOMMENDED FOR THIS MIX IF WILDFLOWERS ARE USED. (THEY HAVE VERY SMALL SEEDS.)
	HARD FESCUE	25	0.57	8/5-10/31	1/4"-1/2"					
	SHEEP FESCUE	25	0.57	11/1-11/30						
	PLUS WILDFLOWER MIX:				1/4"-1/2"					
	BLACK-EYED SUSAN	2	0.05		1/4"-1/2"					
	LANCE-LEAVED COREOPSIS	2	0.05							
	PURPLE CONEFLOWER	2	0.05							
	PARTRIDGE PEA	5	0.11							
	OR ADD CLOVER MIX:									
	WHITE CLOVER	3	0.07							
	RED CLOVER	3	0.07							

ALL SEEDING SHALL BE COMPLETED IN ACCORDANCE WITH THE "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL" SECTION B-4 VEGETATIVE STABILIZATION. SEE PAGES B.18 THROUGH B.35. FOR ADDITIONAL SEED MIXES, SEE TABLE B.1 AND B.3. OBTAIN APPROVAL FROM SEDIMENT CONTROL INSPECTOR FOR SUBSTITUTE MIXES.

8. ANY SPOIL OR BORROW WILL BE PLACED AT A SITE APPROVED BY THE SOIL CONSERVATION DISTRICT AND THE CLIENT. AN APPROVED SITE MUST HAVE A CURRENT E&S PLAN.
9. ALL AREAS REMAINING OR INTENDED TO REMAIN DISTURBED FOR LONGER THAN SEVEN (7) DAYS SHALL BE STABILIZED IN ACCORDANCE WITH THE USDA, NATURAL RESOURCES CONSERVATION SERVICE STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL IN DEVELOPING AREAS FOR CRITICAL AREA STABILIZATION.
10. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR OR SUBCONTRACTOR TO NOTIFY THE ENGINEER OF ANY DEVIATION FROM THIS PLAN. ANY CHANGE MADE IN THIS PLAN WITHOUT WRITTEN AUTHORIZATION FROM THE ENGINEER, WILL PLACE RESPONSIBILITY OF SAID CHANGE ON THE CONTRACTOR OR SUBCONTRACTOR.
11. OWNER/DEVELOPER OR REPRESENTATIVE SHALL CONTACT THE APPROPRIATE ENFORCEMENT AUTHORITY OR ITS AGENT AT THE FOLLOWING STAGES OF THE PROJECT OR:
    A. PRIOR TO START OF EARTH DISTURBANCE;
    B. UPON COMPLETION OF THE INSTALLATION OF PERIMETER EROSION AND SEDIMENT CONTROLS, BUT BEFORE PROCEEDING WITH ANY OTHER EARTH DISTURBANCE OR GRADING,
    C. PRIOR TO THE START OF ANOTHER PHASE OF CONSTRUCTION OR OPENING OF ANOTHER GRADING UNIT,
    D. PRIOR TO THE REMOVAL OF SEDIMENT CONTROL PRACTICES.
12. MAINTENANCE SHALL BE PREFORMED AS NECESSARY TO ENSURE THAT STABILIZED AREAS CONTINUOUSLY MEET THE APPROPRIATE REQUIREMENTS OF "2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL".
13. APPROVED PLANS SHALL REMAIN VALID FOR 2 YEARS FROM THE DATE OF APPROVAL, WITH THE EXCEPT OF SURFACE MINE AND LANDFILL PLANS WHICH REMAIN VALID FOR 5 YEARS FROM THE DATE OF APPROVAL UNLESS SPECIFICALLY EXTENDED OR RENEWED BY THE APPROVAL AUTHORITY.
14. A MARYLAND DEPARTMENT OF THE ENVIRONMENT NOTICE OF INTENT (NOI) GENERAL PERMIT FOR CONSTRUCTION ACTIVITY IS REQUIRED FOR ALL CONSTRUCTION ACTIVITY IN MARYLAND WITH A PLANNED TOTAL DISTURBANCE OF 1 ACRE OR MORE.
15. AS MANDATED BY THE NOTICE OF INTENT (NOI) GENERAL PERMIT ISSUED BY THE MARYLAND DEPARTMENT OF THE ENVIRONMENT, AN INSPECTION MUST BE PERFORMED ONSITE OF ALL SEDIMENT CONTROLS ON A WEEKLY BASIS AND AFTER EVERY RAINFALL EVENT. ALL SELF INSPECTIONS MUST BE MAINTAINED ALONG WITH ALL APPLICABLE GOVERNING AGENCY INSPECTION REPORTS IN A LOG BOOK, TO BE KEPT ONSITE AT ALL TIMES.

Standard Erosion and Sediment Control Notes

1. The contractor shall notify the Maryland Department of the Environment (MDE) Sediment Control Inspector at 410-537-3510 and the Wicomico County Department of Public Works (DPW) at 410-548-4875 at least 48 hours prior to commencing any land disturbing activities and, unless waived by the Sediment Control Inspector, shall be required to hold a pre-construction meeting at the project site. The contractor must provide the name of the person on the site who is responsible for inspection and maintenance of erosion and sediment control measures and a copy of their green card to the Sediment Control Inspector.
2. All projects with construction activities disturbing 1 acre or more are required to submit a General Permit (NOI) to MDE to comply with the General Permit for Construction Activity for Stormwater Discharges. The General Permit (NOI) must be approved prior to disturbance activities. To obtain a General Permit (NOI) form, contact the Permits Coordinator at the MDE Compliance Program at 410-537-3510.
3. The limit of disturbance shall be clearly delineated in the field prior to the pre-construction meeting and any grading activities to ensure compliance with the approved plan.
4. The approved Erosion and Sediment Control Plan must be kept at the project site.
5. The Wicomico Soil Conservation District (WSCD) reserves the right to modify the Erosion and Sediment Control Plans.
6. The WSCD may revoke the approval of the Erosion and Sediment Control Plan if work performed at the project site does not conform to the provisions of the grading permit, to the approved plan or to any written instructions from MDE, Wicomico County DPW or the WSCD.
7. The contractor must request that the Sediment Control Inspector approve work completed in accordance with the approved Erosion and Sediment Control Plan, the grading or building permit and the Wicomico County Erosion and Sediment Control Ordinance at the following points of project development:
   A. Upon completion of the installation of perimeter erosion and sediment control measures but before proceeding with any other earth disturbance or grading. Other building or grading inspection approvals may not be authorized until this initial approval by MDE is made.
   B. Prior to removal or modification of any sediment control structure(s).
   C. Upon final stabilization of the site and prior to the removal of any sediment control measures.
8. The contractor shall construct all erosion and sediment control measures per the approved plan and construction sequence and shall have them inspected and approved by the Sediment Control Inspector prior to beginning any other land disturbances.
9. The contractor shall ensure that all runoff from disturbed areas is directed to the sediment control devices and shall not remove any erosion or sediment control measure without prior permission from the Sediment Control Inspector.
10. The following minor plan modifications may be approved by the Sediment Control Inspector in the field:
    A. Sediment control structures (except basins and traps) may be moved to meet the existing contours and field conditions, when moving these structures would have no impact on their function or design criteria.
    B. Substitution of perimeter control measures may be made provided the measure substituted is equivalent (i.e., silt fence for straw bales) or is an upgrade of the original measure (i.e., silt fence to a perimeter berm with properly sized outlet).
    C. Addition and extension of perimeter controls (including stone construction entrances) may be made to meet field conditions.

    Any modifications to the plan which are not listed above require the plan to be submitted to the WSCD for review and approval.
11. The contractor shall protect all points of construction ingress and egress to prevent the deposition of materials onto public roads. All materials deposited onto public roads shall be removed immediately.
12. On-site temporary stockpile areas must be placed as shown on the approved plan. If the construction schedule is to exceed 3 days, the stockpile areas must be stabilized. Stockpile areas should not exceed fifteen feet in height. If a stockpile is to exceed fifteen feet in height, it must be shown on the plan to be terraced with pipe slope drains installedand approved by WSCD. Upon the completion of the use of the stockpile area, existing ground surfaces shall be restored to their original conditions and permanently stabilized.
13. Various steps in the sequence of construction may require the contractor to remove excess excavated material to an approved location or to import material from an approved location. For purposes of this plan, an approved location shall be one which is operating under an approved erosion and sediment control plan and an active grading permit at the time of construction.
14. The contractor shall inspect daily and maintain continuously in an effective operating condition all erosion and sediment control measures until such time as they are removed with prior permission from the Sediment Control Inspector.
15. Following initial soil disturbance or re-disturbance, permanent or temporary stabilization shall be completed within:
    A. Three (3) calendar days as to the surface of all perimeter controls, dikes, swales, ditches, perimeter slopes, and all slopes equal to or greater than 3 horizontal to 1 vertical (3:1), and
    B. Seven (7) days as to all other disturbed or graded areas on the project site.

    The above requirements do not apply to those areas which are shown on the plan and are currently being used for material storage or for those areas on which actual construction activities are currently being performed or to interior areas of a surface mine site where the stabilization material would contaminate the recoverable resource.Maintenance shall be performed as necessary to ensure that the stabilized areas continuously meet the appropriate requirements of the most current Maryland Standards and Specifications for Soil Erosion and Sediment Control.
16. Sediment control practices will be maintained until the entire contributing area to the practice has been permanently stabilized and meets the satisfaction of the Sediment Control Inspector. Sediment controls may only be removed with the authorization of the Sediment Control Inspector.
17. All areas disturbed by the removal of sediment control devices must be immediately stabilized.
18. Surface drainage flows over unstabilized cut and fill slopes shall be controlled by either preventing drainage flows from traversing the slopes or by installing protective devices to convey the water downslope without causing erosion.Dikes shall be installed and maintained at the top of cut or fill slopes until the slope and drainage area to it are fully stabilized, at which time the dikes must be removed and final grading done to promote sheet flow drainage. Erosion control measures must be implemented at points of concentrated flow where erosion is likely to occur.
19. No permanent cut or fill slope with a gradient steeper than 3:1 will be permitted in lawn maintenance areas. A slope gradient of up to 2:1 will be permitted in non-maintenance areas provided that those areas are indicated on the erosion and sediment control plans with a low-maintenance ground cover specified for permanent stabilization. Slope gradient steeper than 2:1 will not be permitted with vegetation stabilization.
20. All flow lines are to be stabilized with sod or seed with erosion control matting to a depth of flow of 1 foot.
21. Sediment traps or basins are not permitted within 20 feet of a foundation which is existing or under construction. No structure may be constructed within 20 feet of an active sediment trap or basin.
22. Temporary sediment traps and sediment basins shall be cleaned out and restored to the original dimensions when sediment has accumulated to one half (1/2) the wet storage depth of the trap or basin.
23. Sediment removed from traps (and basins) shall be placed and stabilized in approved areas, but not within a floodplain, wetland or forest retention area. When pumping sediment laden water, the discharge must be directed to a sediment trapping device prior to release from the site.
24. For approved dewatering strategies for traps and basins, see section F of the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control. Pumping sediment laden water into the waters of the State without filtration is strictly forbidden.
25. Sediment control devices placed in infiltration areas must have bottom elevations at least two (2) feet higher than the finished grade elevation of the infiltration practice. When converting a sediment trap to an infiltration device, all accumulated sediment must be removed and disposed of prior to final grading of infiltration device.
26. The developer is responsible for obtaining all necessary permits prior to any construction activities. Further, the issuance of a grading permit does not relieve the developer of the responsibility to obtain any additional local, state or federal permits.

NOTE TO CONTRACTOR:
EROSION/SEDIMENT CONTROL WILL BE STRICTLY ENFORCED

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

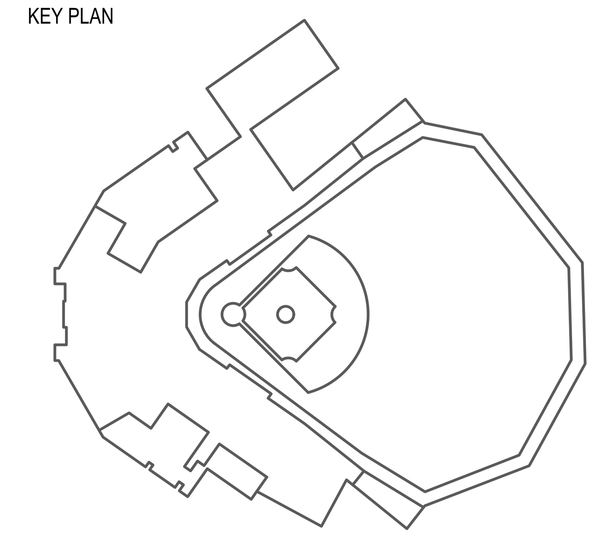
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL

PROJECT MANAGER

Project Architect

Project Model Lead

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY	TW	DATE	6/15/2024
PROJECT NO.	D2230059	SCALE	NONE

DRAWING NAME
EROSION & SEDIMENT CONTROL DETAILS

PHASE: CD
DRAWING NO.: C20

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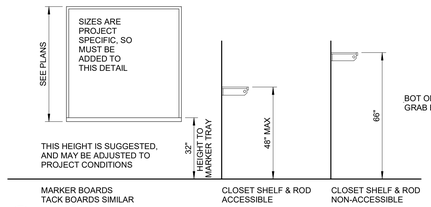
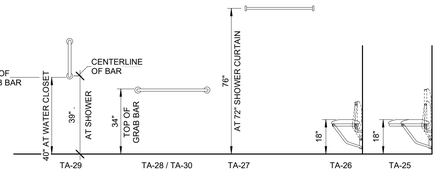
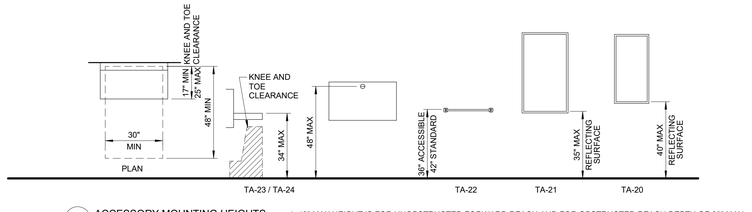


N MISCELLANEOUS MOUNTING HEIGHTS
SCALE: 3/8" = 1'-0"

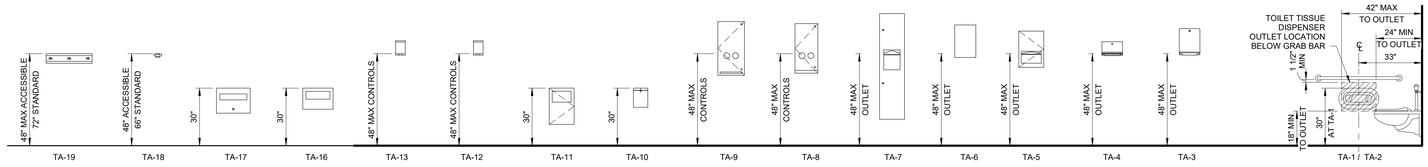


M2 ACCESSORY MOUNTING HEIGHTS
SCALE: 3/8" = 1'-0"



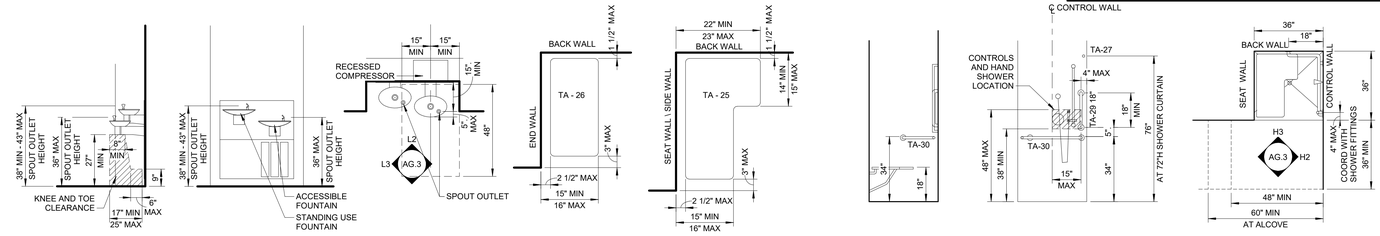
M1 ACCESSORY MOUNTING HEIGHTS
SCALE: 3/8" = 1'-0"

1. 48" MAX HEIGHT IS FOR UNOBSTRUCTED FORWARD REACH AND FOR OBSTRUCTED REACH DEPTH OF 20" MAX.



M ACCESSORY MOUNTING HEIGHTS
SCALE: 3/8" = 1'-0"

2. ALL OF AN OPERABLE PART IS TO BE WITHIN MOUNTING HEIGHT. 3. FOR SURFACE MOUNTED ACCESSORIES AND RECESSED ACCESSORIES PROJECTING MORE THAN 1/4" MAX, COORDINATE CLEARANCE AROUND GRAB BARS. SEE DETAIL G. 4. RECESSED FIXTURES SHOULD NOT BE LOCATED IN FIRE RATED PARTITIONS.

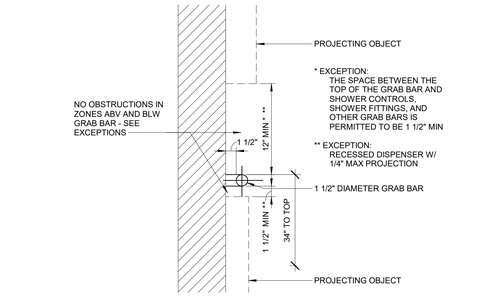


L3 SECTION — L2 ELEVATION — L1 PLAN — K2 RECTANGULAR SHOWER SEAT — K1 L SHAPED SHOWER SEAT — H3 BACK WALL ELEVATION — H2 CONTROL WALL ELEVATION — H1 PLAN

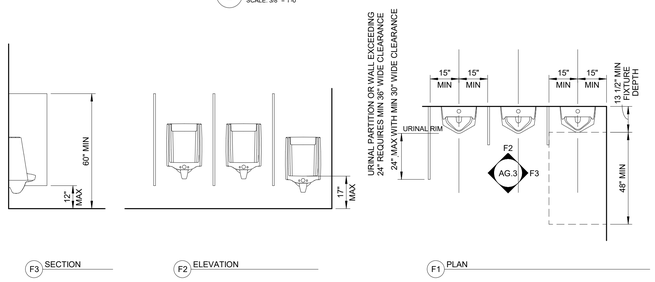
L ACCESSIBLE AND NON-ACCESSIBLE RECESSED DRINKING FOUNTAIN
SCALE: 3/8" = 1'-0"

K ACCESSIBLE SHOWER SEATS
SCALE: 3/4" = 1'-0"

H ACCESSIBLE TRANSFER SHOWER COMPARTMENT
SCALE: 3/8" = 1'-0"

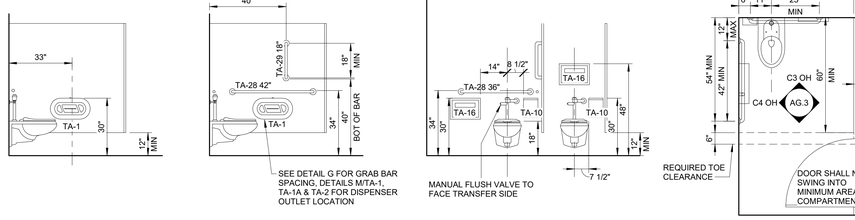


G GRAB BAR SPACING
SCALE: 1 1/2" = 1'-0"



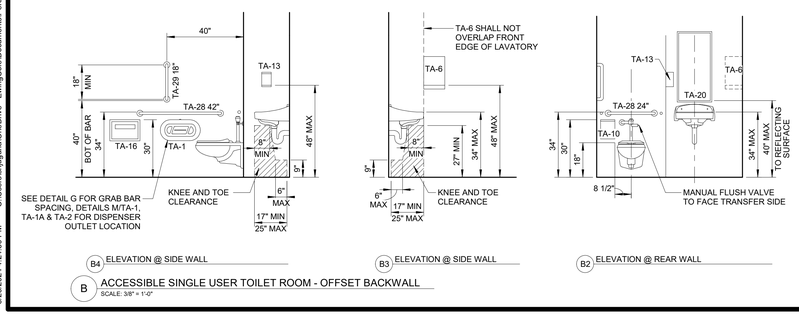
F3 SECTION — F2 ELEVATION — F1 PLAN

F ACCESSIBLE AND NON-ACCESSIBLE URINALS
SCALE: 3/8" = 1'-0"



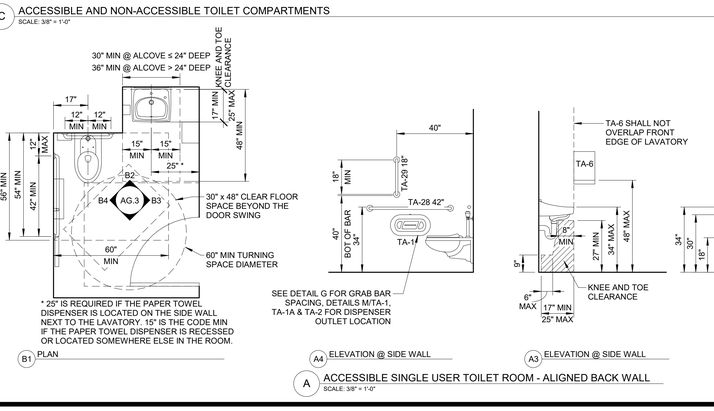
C5 ELEVATION @ SIDE WALL — C4 ELEVATION @ SIDE WALL — C3 ELEVATION @ REAR WALL — C2 PLAN — C1 PLAN

C ACCESSIBLE AND NON-ACCESSIBLE TOILET COMPARTMENTS
SCALE: 3/8" = 1'-0"



B4 ELEVATION @ SIDE WALL — B3 ELEVATION @ SIDE WALL — B2 ELEVATION @ REAR WALL

B ACCESSIBLE SINGLE USER TOILET ROOM - OFFSET BACKWALL
SCALE: 3/8" = 1'-0"



B4 ELEVATION @ SIDE WALL — A4 ELEVATION @ SIDE WALL — A3 ELEVATION @ SIDE WALL — A2 ELEVATION @ BACK WALL — A1 PLAN

A ACCESSIBLE SINGLE USER TOILET ROOM - ALIGNED BACK WALL
SCALE: 3/8" = 1'-0"

LEGEND

THIS DRAWING IS FOR MOUNTING LOCATION INFORMATION ONLY. SOME ITEMS OR CONDITIONS MAY BE SHOWN WHICH ARE NOT INCLUDED IN THIS PROJECT, THEY MAY BE DISREGARDED.

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ACCESSORY LEGEND

TA-1 SURFACE TOILET TISSUE DISPENSER ROLL TYPE
TA-2 SURFACE TOILET TISSUE DISPENSER ROLL TYPE BY VENDOR
TA-3 SURFACE PAPER TOWEL DISPENSER C FOLD - LARGE
TA-4 SURFACE PAPER TOWEL DISPENSER C FOLD - SMALL
TA-5 RECESSED PAPER TOWEL DISPENSER C FOLD
TA-6 SURFACE PAPER TOWEL DISPENSER ROLL TYPE BY VENDOR
TA-7 RECESSED PAPER TOWEL DISPENSER / WASTE RECEPTACLE
TA-8 SURFACE NAPKIN / TAMPON VENDOR
TA-9 RECESSED NAPKIN / TAMPON VENDOR
TA-10 SURFACE NAPKIN DISPOSAL
TA-11 RECESSED NAPKIN DISPOSAL
TA-12 SURFACE SOAP DISPENSER BY VENDOR
TA-13 SURFACE SOAP DISPENSER
TA-14 LAVATORY MOUNTED SOAP DISPENSER
TA-15 AUTOMATIC LAVATORY MOUNTED SOAP DISPENSER
TA-16 SURFACE SEAT COVER DISPENSER
TA-17 RECESSED SEAT COVER DISPENSER
TA-18 ROBE HOOK
TA-19 MOP STRIP
TA-20 FRAMED MIRROR 18x36
TA-21 FRAMED MIRROR 24x60
TA-22 TOWEL BAR 24"
TA-23 SURFACE BABY CHANGING STATION HORIZONTAL
TA-24 RECESSED BABY CHANGING STATION HORIZONTAL
TA-25 L SHAPED SHOWER SEAT
TA-26 RECTANGULAR SHOWER SEAT
TA-27 SHOWER CURTAIN ROD
TA-28 GRAB BAR STRAIGHT HORIZONTAL
TA-29 GRAB BAR STRAIGHT VERTICAL
TA-30 GRAB BAR TWO WALL SHOWER STALL - SMALL
TA-31 GRAB BAR SWING TYPE

NOTES:
1. DIMENSIONS ARE TO FACE OF WALL FINISH.
2. WARM AIR DRYERS ARE LISTED SEPARATELY

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME

MOUNTING HEIGHTS & CLEARANCES

PHASE CD
DRAWING NO. AG.3

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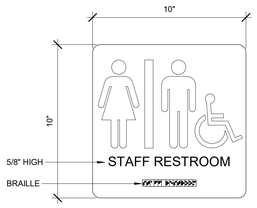


T-5

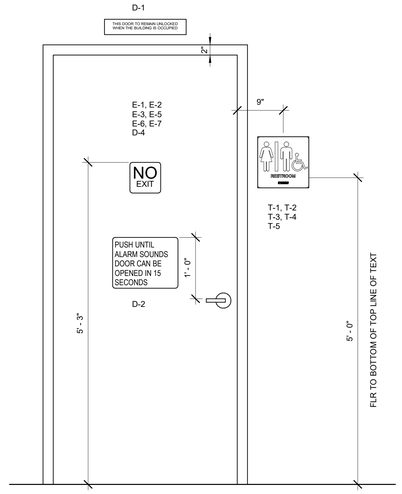
T-4

T-3

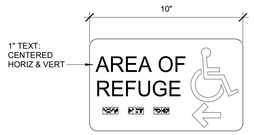
T-2

T-1

T TOILET ROOM SIGNS
SCALE: 3" = 1'-0"



M MOUNTING HEIGHTS AND CLEARANCES
SCALE: 1" = 1'-0"



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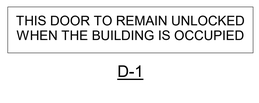

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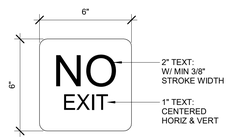

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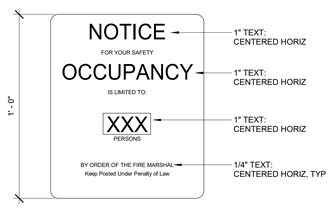

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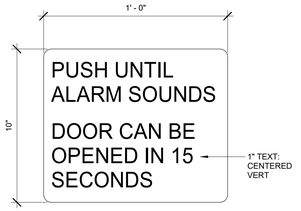
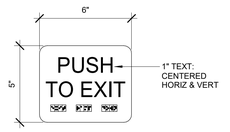


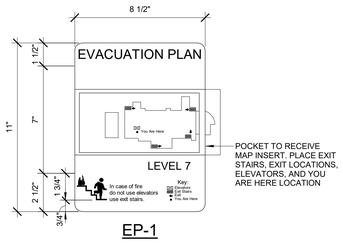
D-2



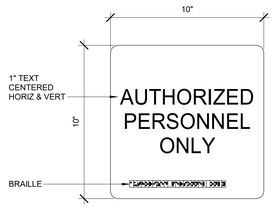
D-3

AR O OCCUPANCY & AREA OF REFUGE SIGNS
SCALE: 3" = 1'-0"

D MISC REQUIRED SIGNS
SCALE: 3" = 1'-0"



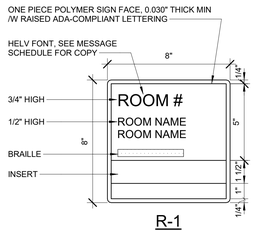
EP-1



R-2

NOTE:

1. DELETE INSERT AT EXTERIOR APPLICATIONS
2. COLORS TBD FROM FULL RANGE
3. PLAQUE AND TEXT SIZES DOUBLE AT EXTERIOR APPLICATIONS



R-1

EP EVACUATION PLAN SIGN
SCALE: 3" = 1'-0"

R TYPICAL ROOM SIGNAGE
SCALE: 3" = 1'-0"

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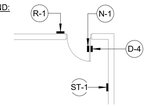
NOTES:

1. REFER TO SIGNAGE PLAN SHEETS FOR SIGNAGE SCOPE & LOCATIONS.
2. FOR SIGNAGE TYPE EP-1: PROVIDE UNIQUE SIGN FOR EACH LOCATION INDICATING APPLICABLE FLOOR LEVEL, BUILDING PLAN, AND "YOU ARE HERE" LOCATION.
3. FOR E AND ST SERIES SIGN TYPES PROVIDE UNIQUE SIGN FOR EACH FLOOR INDICATING APPLICABLE INFORMATION AND EXIT STAIR.
4. ALL BRAILLE IS GRADE 2.
5. ALL RAISED CHARACTERS ARE BETWEEN 5/8" & 2" IN HEIGHT & MADE IN CONTRASTING COLOR TO THE BACKGROUND.
6. ALL RAISED CHARACTERS, BRAILE, AND PICTOGRAMS TO BE LOCATED BETWEEN 48-IN AND 60-IN AFF.
7. WHERE A SIGN IS PROVIDED AT A DOOR, INSTALL AT LATCH SIDE. SIGNS ON DOUBLE DOORS WITH TWO ACTIVE LEAFS SHALL BE AT THE RIGHT SIDE OF THE RIGHT HAND DOOR. SIGNS ON DOUBLE DOORS WITH AN INACTIVE LEAF ARE TO BE INSTALLED ON INACTIVE LEAF. MOUNT ON NEAREST ADJACENT WALL WHERE THERE IS INSUFFICIENT WIDTH AT DOOR.
8. FOR SIGNS MOUNTED ON GLAZING OR TRANSPARENT PARTITIONS INSTALL AN EQUAL SIZE BLANK SIGN ON OPPOSITE SIDE OF PARTITION.
9. SUBMIT ALL SIGNS FOR APPROVAL OF GRAPHICS AND TEXT PRIOR TO CONSTRUCTION.

SIGNAGE PLAN LEGEND:



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DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

CODE REQUIRED SIGNAGE

PHASE
CD

DRAWING NO.
AG.4

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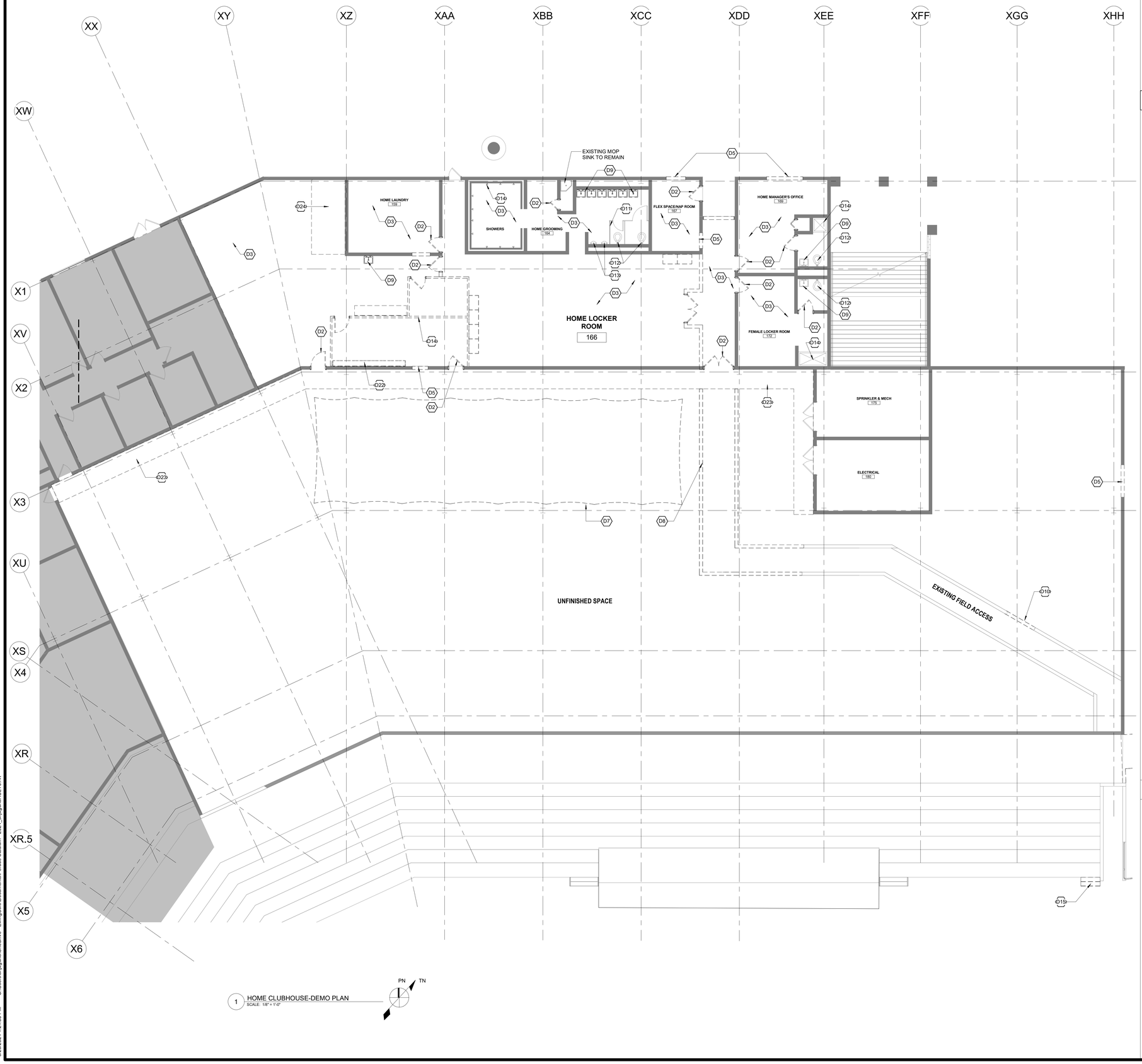

1 HOME CLUBHOUSE-DEMO PLAN
SCALE: 1/8" = 1'-0"

PN TN

DEMOLITION LEGEND

- WALL TO BE REMOVED
- EXISTING WALL TO REMAIN
- DOOR TO BE REMOVED
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- AREA TO BE REMOVED. REFER TO KEYNOTES FOR ADDITIONAL INFORMATION.

GENERAL NOTES

1. DEMOLITION PLANS ARE INTENDED TO INDICATE GENERAL AREAS OF DEMOLITION.
2. PROVIDE ADDITIONAL DEMOLITION AS REQUIRED TO FULFILL NEW CONSTRUCTION. FIELD VERIFY ALL DIMENSIONS AND COORDINATE WITH PLANS. DEVIATIONS FROM THE CONTRACT DOCUMENTS NECESSITATED BY FIELD CONDITIONS SHOULD BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO PROCEEDING WITH THE WORK.
3. REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR ADDITIONAL INFORMATION REQUIRED TO FULFILL CONSTRUCTION REQUIREMENTS. ALL MECHANICAL AND ELECTRICAL WORK NOTED ON THE DEMOLITION DRAWINGS SHALL BE REMOVED BY THE APPROPRIATE DIVISION 21, 22, 23, 25, 26, 27 AND 28 SUBCONTRACTORS.
4. PROVIDE STRICT CONTROL OF JOB CLEANING. ERECT NECESSARY DUST PARTITIONS TO PREVENT DUST AND DEBRIS FROM EMANATING FROM DEMOLITION CONSTRUCTION AREA. INSTALL FILTER MEDIA OVER RETURN AIR INTAKES TO PREVENT DUST MIGRATION INTO BUILDING HVAC. KEEP AREA CLEAN.
5. PROVIDE MEANS AND MATERIALS TO PROTECT EXISTING FINISHES AND EQUIPMENT NOT DEMOLISHED OR REMOVED.
6. WHERE FINISHES ARE NOTED TO BE REMOVED AT COLUMNS OR WALLS, REMOVAL SHALL BE SUCH THAT NEW FINISHES MAY BE INSTALLED TO ALIGN WITH EXISTING FINISHES.
7. DO NOT BLOCK EXITS AT ANY TIME. EXIT PATHS MUST REMAIN ACCESSIBLE AT ALL TIMES. PROVIDE TEMPORARY BARRIERS, BARRICADES, LIGHTING, FIRE PROTECTION, ETC. TO PROTECT PERSONEL AND ADJACENT SPACES PER THE REQUIREMENTS OF DIVISION 01 SECTION 'TEMPORARY FACILITIES AND CONTROLS'.
8. EXECUTE WORK WITHIN THE BUILDING REGULATIONS FOR DEMOLITION AND REMOVAL OF DEBRIS. DEMOLITION WORK AND DEBRIS REMOVAL SHALL BE CONFINED TO THE HOURS PERMITTED BY THE BUILDING OWNER.
9. MAINTAIN ALL SERVICES TO ADJACENT OCCUPIED SPACES THROUGHOUT THE DURATION OF CONSTRUCTION. COMPLY AND COORDINATE ALL WORK WITH BUILDING OWNER REGARDING HEAT, WATER, ELECTRICITY, DELIVERIES, ACCESS, AVAILABILITY, NOISE CONTROL.
10. CONTRACTOR SHALL INSURE THAT ALL SECURITY DEVICES REMAIN OPERATIONAL DURING CONSTRUCTION.
11. THE ELECTRICAL CONTRACTOR SHALL FURNISH A SYSTEM OF TEMPORARY LIGHT & POWER IN THE SPACE DURING CONSTRUCTION. DISCONNECT ELECTRIC AND COORDINATE RELOCATION OF DATA OUTLETS WITH OWNER. RELOCATE FIRE ALARM DEVICE AS REQUIRED.
12. IN PARTITIONS TO BE REMOVED, REMOVE AND CAP ALL OUTLETS, SWITCHES, WIRES THERMOSTATS, ETC. TO THEIR SOURCE AS REQUIRED BY CODE.
13. WHERE NEW WALLS WILL ABUT EXISTING CORNERS, REMOVE CORNER GUARD AND REPAIR CORNER PRIOR TO INSTALLATION.
14. CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING AND/OR REPAIRING ANY DAMAGE CAUSED BY HIM OR HIS SUBCONTRACTORS TO EXISTING CONSTRUCTION OR WHERE PARTITIONS, CEILINGS, MILLWORK OR EQUIPMENT HAS BEEN REMOVED. REFINISH TO MATCH EXISTING ADJACENT FINISH, OR AS NOTED HEREIN.
15. UNLESS NOTED OTHERWISE, REMOVE EXISTING PROJECTIONS, HANGERS, BOLTS, NAILS, BRACKETS, CURTAIN RODS, VALANCES, ETC. FROM EXISTING WALLS AND COLUMNS. PATCH ALL HOLES TO MATCH ADJACENT SURACES FOR THE INSTALLATION OF NEW FINISHES.
16. PATCH AND REPAIR ALL EXISTING FIRE-RATED CONSTRUCTION AND ASSEMBLIES AS REQUIRED TO MAINTAIN THEIR RATING.
17. WHERE REMOVAL OF PARTITIONS OR WALLS RESULTS IN ADJACENT SPACES BECOMING ONE, REWORK FLOOR AND WALLS TO PROVIDE A SMOOTH PLANE WITHOUT BREAKS, STEPS OR BULKHEADS. THE SUBSURFACE SHALL BE PATCHED AND TREATED TO PRODUCE A SURFACE WHICH WILL ELIMINATE "TELEGRAPHING" OF EXISTING JOINTS THROUGHT THE NEW FLOORING. INSTALL UNDERLAYMENT PER DIVISION 03 SECTION "GYPSUM CEMENT UNDERLAYMENT".
18. REMOVE ALL CEILINGS, GRID, LIGHT FIXTURES, DIFFUSERS, FIRE ALARM / SECURITY DEVICES, ETC. U.N.O.
19. CAREFULLY REMOVE EXISITING SUSPENDED ACOUSTIC TILE CEILING TO EXTENT REQUIRED TO ACCOMMODATE NEW MECHANICAL AND ELECTRICAL WORK BOTH INSIDE AND OUTSIDE THE PROJECT AREA LINE. STORE UNDAMAGED CEILING AND SUPORT GRID FOR REINSTALLATION.
20. CAREFULLY REMOVE EXISTING DRYWALL [PLASTER] CEILINGS TO EXTENT REQUIRED TO ACCOMMODATE NEW MECHANICAL AND ELECTRICAL WORK BOTH INSIDE AND OUTSIDE THE PROJECT AREA LINE. REINSTALL SUPPORT STRUCTURE AND INSTALL NEW DRYWALL [PLASTER] AND FINISH TO MATCH EXISTING ADJACENT FINISHES TO THE SATISFACTION OF THE ARCHITECT AND OWNER.
21. REMOVE ALL FLOOR BASE, CARPET, LVT, VCT, AND OTHER MISCELLANEOUS FLOOR COVERINGS. PREPARE SURFACES FOR NEW FINISHES. HOLES IN UL RATED FLOORS AND WALLS RESULTING FROM DEMOLITION OR REMOVALS SHALL BE REPAIRED IN A MANNER CONSISTENT WITH THE ADJACENT UL RATED CONSTRUCTION AND BE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION.
22. CONTRACTOR SHALL CONSULT WITH THE OWNER IN ADVANCE OF DOING WORK TO DETERMINE DISPOSITION OF ALL FIXTURES, CABINETS, SERVICES, EQUIPMENT AND ITEMS REMOVED DURING THE DEMOLITION. REMOVE EXISTING FURNISHINGS AND EQUIPMENT LEFT BEHIND TO BE DISCARDED BY OWNER.
23. TRENCH FLOOR IN OPEN OFFICE AREA FOR WORKSTATION FLOOR BOXES. COORDINATE WITH ELECTRICAL AND FURNITURE PLANS.

KEYNOTES

- D2 REMOVE EXISTING DOOR, FRAME AND HARDWARE.
- D3 MECHANICALLY REMOVE EXISTING FLOORING AND UNDERLAYMENT MATERIALS TO CONCRETE SLAB IN THEIR ENTIRETY. SCARIFY CONCRETE AS REQUIRED TO REMOVE ALL ADHESIVE RESIDUE. THE USE OF REMOVAL CHEMICALS IS NOT PERMITTED.
- D5 CUT NEW OPENING IN WALL SYSTEM SUFFICIENT TO INSTALL NEW HOLLOW METAL FRAME TO DIMENSIONS INDICATED.
- D7 REMOVE BATTING TUNNEL NET
- D8 REMOVE CONCRETE WALLS ALONG FIELD ACCESS PATH
- D9 REMOVE SINK AND EXISTING MIRROR (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D10 CUT WALL SYSTEM TO CREATE OPENING FOR RAMP
- D11 REMOVE TOILET PARTITIONS
- D12 REMOVE TOILET (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D13 REMOVE URINAL (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D14 REMOVE SHOWER HEAD & CONTROLS (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D15 REMOVE FIELD ACCESS STEPS AND GATE, INFILL WITH FENCE AND PADDING TO MATCH EXISTING
- D22 RELOCATE EXISTING ELECTRICAL EQUIPMENT
- D23 REMOVE CONCRETE WALKWAY
- D24 REMOVE CONCRETE CURB

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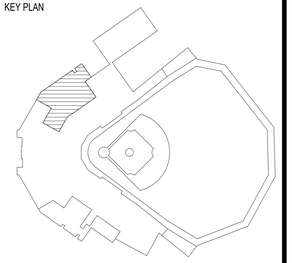

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DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE-DEMO PLAN

PHASE CD

DRAWING NO. AD2.1.1

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1 VISITOR CLUBHOUSE -DEMO PLAN
SCALE: 1/8" = 1'-0"

PN TN

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- EXISTING WALL TO REMAIN
- DOOR TO BE REMOVED
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4. PROVIDE STRICT CONTROL OF JOB CLEANING. ERECT NECESSARY DUST PARTITIONS TO PREVENT DUST AND DEBRIS FROM EMANATING FROM DEMOLITION CONSTRUCTION AREA. INSTALL FILTER MEDIA OVER RETURN AIR INTAKES TO PREVENT DUST MIGRATION INTO BUILDING HVAC. KEEP AREA CLEAN.
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14. CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING AND/OR REPAIRING ANY DAMAGE CAUSED BY HIM OR HIS SUBCONTRACTORS TO EXISTING CONSTRUCTION OR WHERE PARTITIONS, CEILINGS, MILLWORK OR EQUIPMENT HAS BEEN REMOVED. REFINISH TO MATCH EXISTING ADJACENT FINISH, OR AS NOTED HEREIN.
15. UNLESS NOTED OTHERWISE, REMOVE EXISTING PROJECTIONS, HANGERS, BOLTS, NAILS, BRACKETS, CURTAIN RODS, VALANCES, ETC. FROM EXISTING WALLS AND COLUMNS. PATCH ALL HOLES TO MATCH ADJACENT SURACES FOR THE INSTALLATION OF NEW FINISHES.
16. PATCH AND REPAIR ALL EXISTING FIRE-RATED CONSTRUCTION AND ASSEMBLIES AS REQUIRED TO MAINTAIN THEIR RATING.
17. WHERE REMOVAL OF PARTITIONS OR WALLS RESULTS IN ADJACENT SPACES BECOMING ONE, REWORK FLOOR AND WALLS TO PROVIDE A SMOOTH PLANE WITHOUT BREAKS, STEPS OR BULKHEADS. THE SUBSURFACE SHALL BE PATCHED AND TREATED TO PRODUCE A SURFACE WHICH WILL ELIMINATE "TELEGRAPHING" OF EXISTING JOINTS THROUGHT THE NEW FLOORING. INSTALL UNDERLAYMENT PER DIVISION 03 SECTION "GYPSUM CEMENT UNDERLAYMENT".
18. REMOVE ALL CEILINGS, GRID, LIGHT FIXTURES, DIFFUSERS, FIRE ALARM / SECURITY DEVICES, ETC. U.N.O.
19. CAREFULLY REMOVE EXISITING SUSPENDED ACOUSTIC TILE CEILING TO EXTENT REQUIRED TO ACCOMMODATE NEW MECHANICAL AND ELECTRICAL WORK BOTH INSIDE AND OUTSIDE THE PROJECT AREA LINE. STORE UNDAMAGED CEILING AND SUPORT GRID FOR REINSTALLATION.
20. CAREFULLY REMOVE EXISTING DRYWALL [PLASTER] CEILINGS TO EXTENT REQUIRED TO ACCOMMODATE NEW MECHANICAL AND ELECTRICAL WORK BOTH INSIDE AND OUTSIDE THE PROJECT AREA LINE. REINSTALL SUPPORT STRUCTURE AND INSTALL NEW DRYWALL [PLASTER] AND FINISH TO MATCH EXISTING ADJACENT FINISHES TO THE SATISFACTION OF THE ARCHITECT AND OWNER.
21. REMOVE ALL FLOOR BASE, CARPET, LVT, VCT, AND OTHER MISCELLANEOUS FLOOR COVERINGS. PREPARE SURFACES FOR NEW FINISHES. HOLES IN UL RATED FLOORS AND WALLS RESULTING FROM DEMOLITION OR REMOVALS SHALL BE REPAIRED IN A MANNER CONSISTENT WITH THE ADJACENT UL RATED CONSTRUCTION AND BE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION.
22. CONTRACTOR SHALL CONSULT WITH THE OWNER IN ADVANCE OF DOING WORK TO DETERMINE DISPOSITION OF ALL FIXTURES, CABINETS, SERVICES, EQUIPMENT AND ITEMS REMOVED DURING THE DEMOLITION. REMOVE EXISTING FURNISHINGS AND EQUIPMENT LEFT BEHIND TO BE DISCARDED BY OWNER.
23. TRENCH FLOOR IN OPEN OFFICE AREA FOR WORKSTATION FLOOR BOXES. COORDINATE WITH ELECTRICAL AND FURNITURE PLANS.

KEYNOTES

- D2 REMOVE EXISTING DOOR, FRAME AND HARDWARE.
- D3 MECHANICALLY REMOVE EXISTING FLOORING AND UNDERLAYMENT MATERIALS TO CONCRETE SLAB IN THEIR ENTIRETY. SCARIFY CONCRETE AS REQUIRED TO REMOVE ALL ADHESIVE RESIDUE. THE USE OF REMOVAL CHEMICALS IS NOT PERMITTED.
- D5 CUT NEW OPENING IN WALL SYSTEM SUFFICIENT TO INSTALL NEW HOLLOW METAL FRAME TO DIMENSIONS INDICATED.
- D9 REMOVE SINK AND EXISTING MIRROR (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D11 REMOVE TOILET PARTITIONS
- D12 REMOVE TOILET (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D13 REMOVE URINAL (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D14 REMOVE SHOWER HEAD & CONTROLS (OPEN UP EXISTING WALL AS NECESSARY FOR NEW PLUMBING INSTALLATION)
- D15 REMOVE FIELD ACCESS STEPS AND GATE, INFILL WITH FENCE AND PADDING TO MATCH EXISTING
- D19 REMOVE ACOUSTIC CEILING & SUSPENSION SYSTEM

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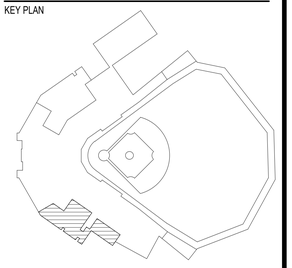

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A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

8400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

VISITOR CLUBHOUSE - DEMO PLAN

PHASE CD
DRAWING NO. AD2.1.2

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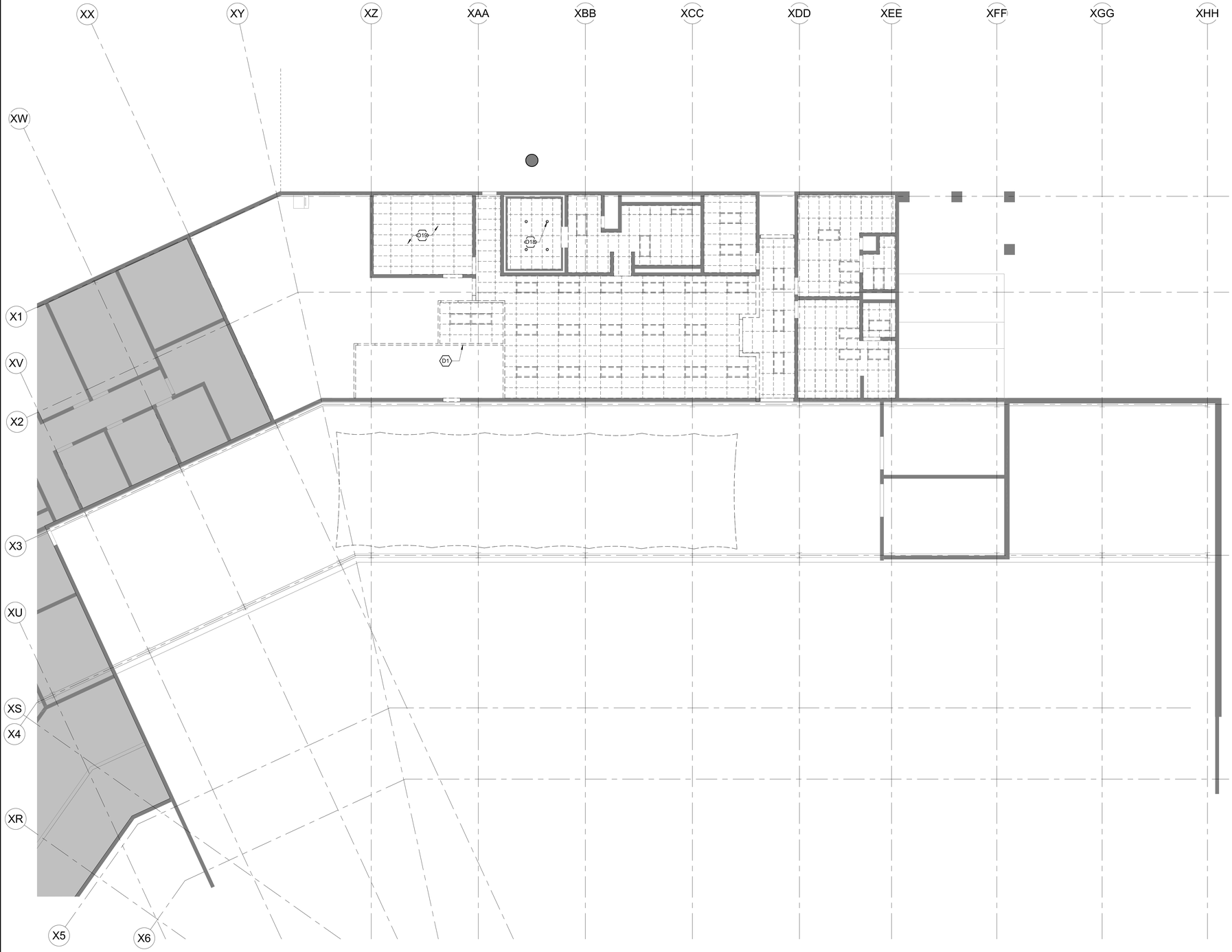

1 HOME CLUBHOUSE-DEMO RCP
SCALE: 1/8" = 1'-0"

PN TN

DEMOLITION LEGEND

- WALL TO BE REMOVED
- EXISTING WALL TO REMAIN
- 2'-0" x 4'-0" ACT CLG, TYPE A
- 2'-0" x 4'-0" RECESSED
- N.I.C. (NOT IN CONTRACT)
- AREA TO BE REMOVED. REFER TO KEYNOTES FOR ADDITIONAL INFORMATION.

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- D1 REMOVE INTERIOR PARTITION WALL SYSTEM
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- D19 REMOVE ACOUSTIC CEILING & SUSPENSION SYSTEM

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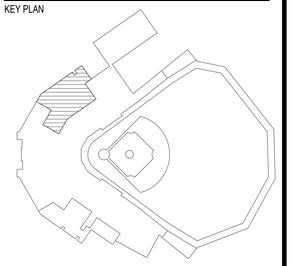

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME
HOME CLUBHOUSE-DEMO RCP

PHASE
CD

DRAWING NO.
AD2.2.1

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1 VISITOR CLUBHOUSE - DEMO RCP
SCALE: 1/8" = 1'-0"

PN TN

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KEYNOTES

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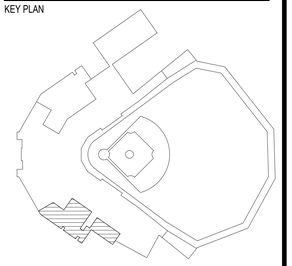

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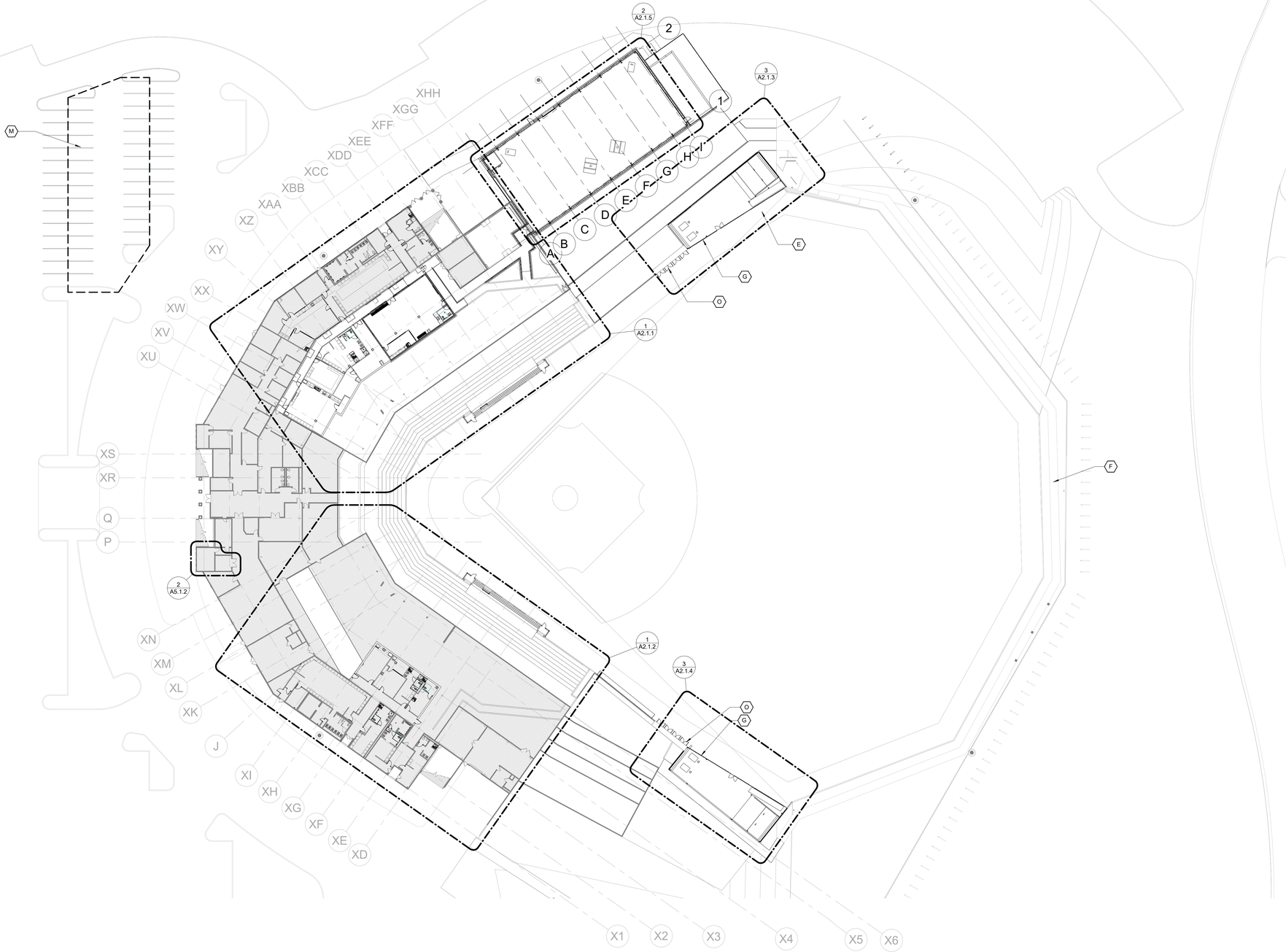

1 CLUBHOUSE REFERENCE PLAN
SCALE: 1/32" = 1'-0"

PN TN

KEYNOTES

- (E) NEW PADDING AT ALL PDL REQUIRED AREAS OF THE FIELD WALL
- (F) NEW BATTER'S EYE - REMOVE PORTION OF CHAINLINK FENCE/POSTS/RAILS/KICKERS TO ACCOMODATE NEW 60'W PRE-ENGINEERED BATTER'S EYE (SPORTSFIELD SPECIALTIES OR SIM)
- (G) EXTEND EXISTING PROTECTIVE NETTING SYSTEM TO OUTFIELD WALL, PROVIDE ARCHED LOWER CHORD AT BULLPENS
- (M) 20-25 FENCED IN PLAYER/ STAFF PARKING SPACES
- (O) NEW MARINE GRADE PLYWOOD DOORS AT EXISTING BULLPEN SEATING WITH FULL WALL PADDING

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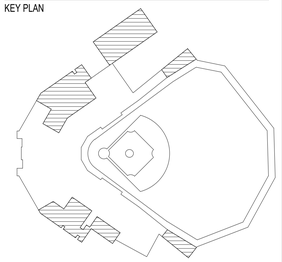

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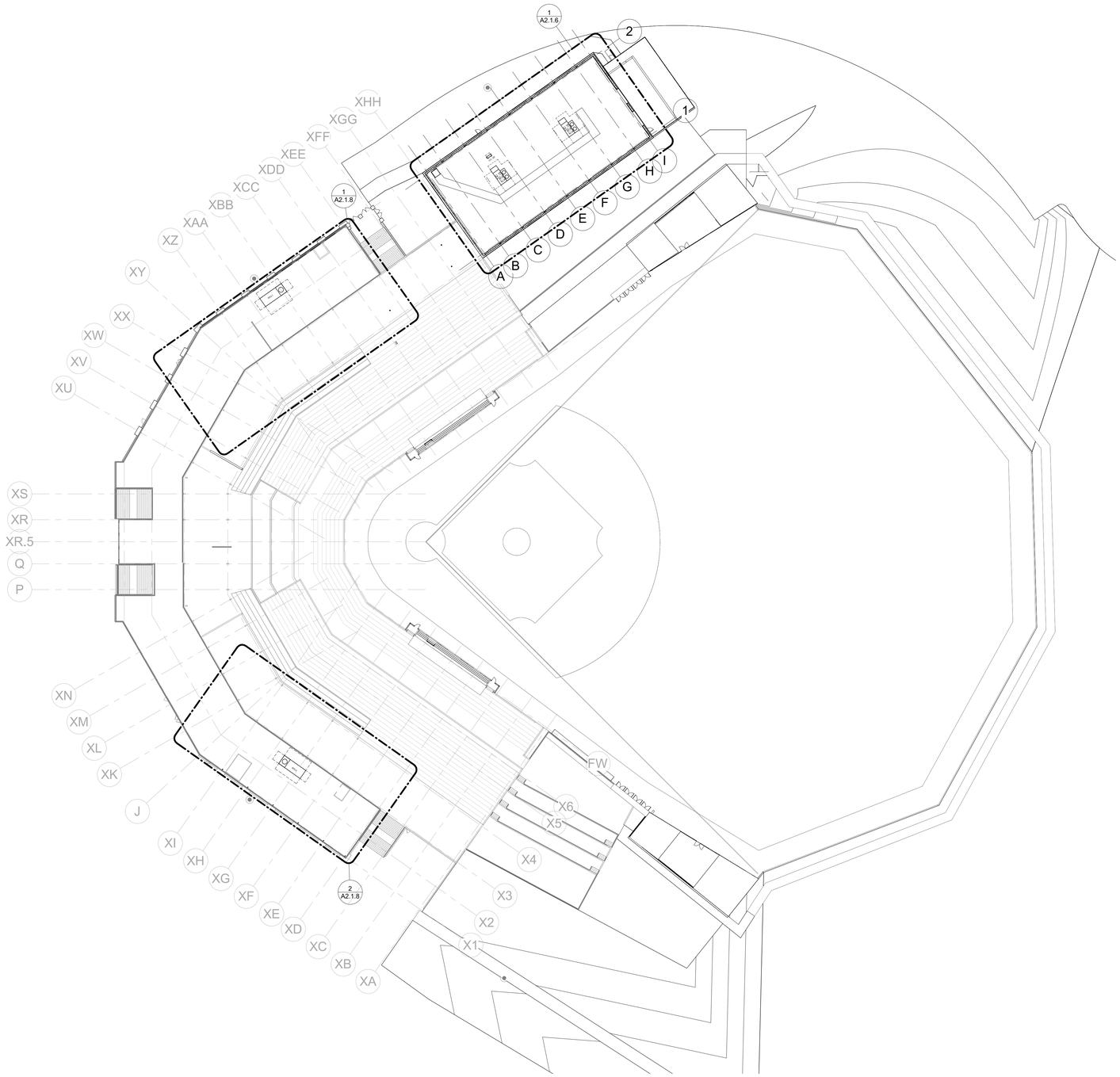

1 LEVEL 3 FLOOR PLAN
SCALE: 1/32" = 1'-0"

PN TN

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
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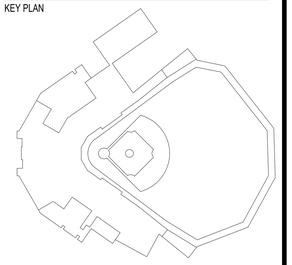

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NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME
CLUBHOUSE ROOF REFERENCE PLAN

PHASE CD
DRAWING NO. A1.2

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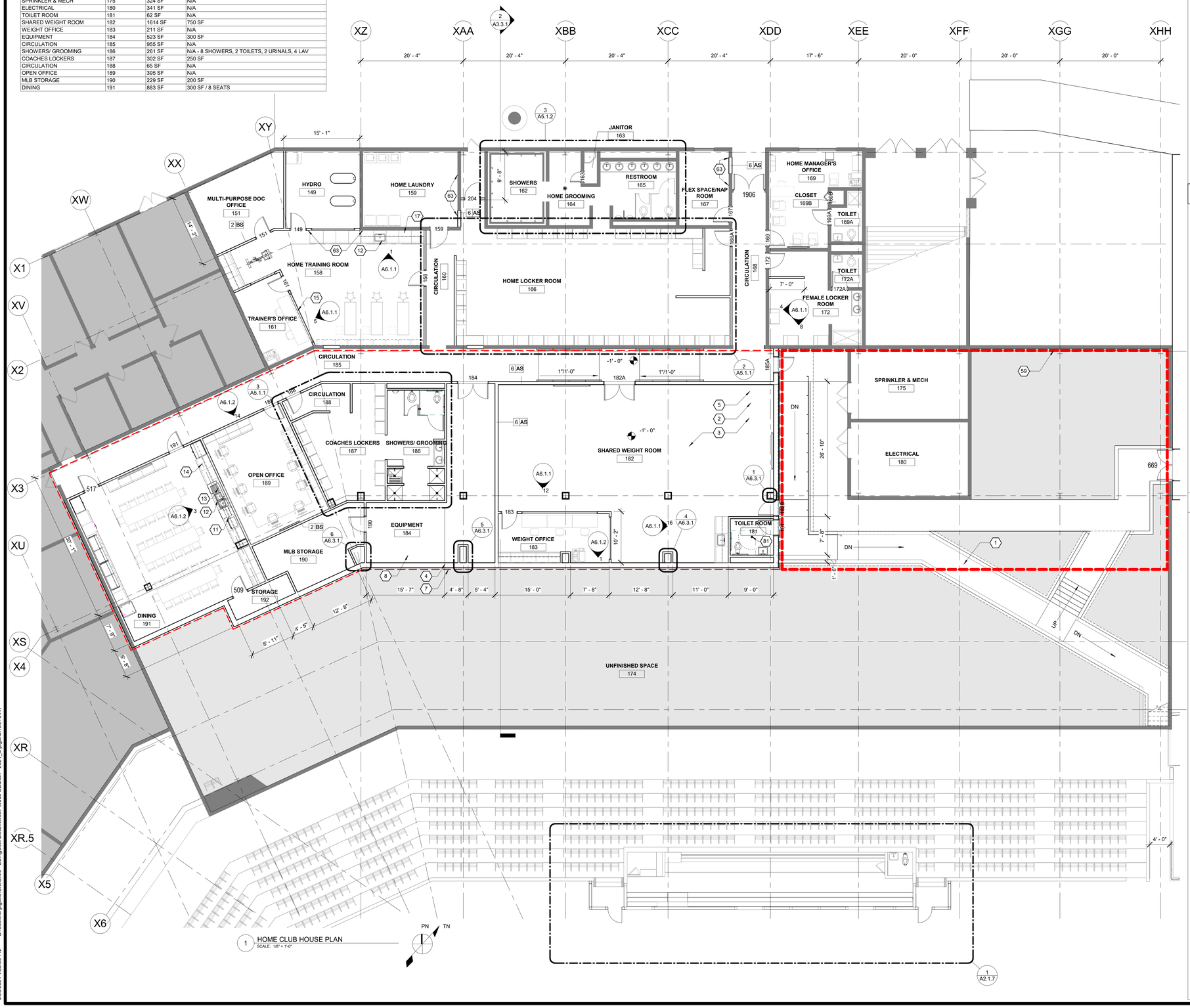
Name	Number	Area	PDL Minimum (SF)
HYDRO	149	225 SF	400 SF; INCLUDES TRAINING RM, OFFICE AND HYDRO
MULTI-PURPOSE DOC OFFICE	151	247 SF	N/A
HOME LAUNDRY	159	283 SF	N/A
CIRCULATION	160	131 SF	N/A
TRAINER'S OFFICE	161	158 SF	N/A
SHOWERS	162	138 SF	N/A - 8 SHOWERS, 2 TOILETS, 2 URINALS, 4 LAV
JANITOR	163	17 SF	N/A
HOME GROOMING	164	111 SF	N/A - 8 SHOWERS, 2 TOILETS, 2 URINALS, 4 LAV
RESTROOM	165	233 SF	N/A
HOME LOCKER ROOM	166	1250 SF	1000 SF
FLEX SPACE/NAP ROOM	167	145 SF	N/A
CIRCULATION	168	202 SF	N/A
HOME MANAGER'S OFFICE	169	283 SF	N/A
TOILET	169A	52 SF	N/A
CLOSET	169B	8 SF	N/A
FEMALE LOCKER ROOM	172	295 SF	200 SF
TOILET	172A	40 SF	N/A
UNFINISHED SPACE	174	Not Enclosed	N/A
SPRINKLER & MECH	175	324 SF	N/A
ELECTRICAL	180	341 SF	N/A
TOILET ROOM	181	62 SF	N/A
SHARED WEIGHT ROOM	182	1614 SF	750 SF
WEIGHT OFFICE	183	211 SF	N/A
EQUIPMENT	184	523 SF	300 SF
CIRCULATION	185	955 SF	N/A
SHOWERS/ GROOMING	186	261 SF	N/A - 8 SHOWERS, 2 TOILETS, 2 URINALS, 4 LAV
COACHES LOCKERS	187	302 SF	250 SF
CIRCULATION	188	65 SF	N/A
OPEN OFFICE	189	395 SF	N/A
MLB STORAGE	190	229 SF	200 SF
DINING	191	883 SF	300 SF / 8 SEATS



1 HOME CLUB HOUSE PLAN
SCALE: 1/8" = 1'-0"

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

GENERAL NOTES

1. ALL INTERIOR PARTITIONS SHOULD BE WALL TYPE 2BS UNLESS OTHERWISE NOTED.
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12. ROOF SHOULD SLOPE 1/4" TOWARD DRAINS WHERE INDICATED ON ROOF PLAN TYPICALLY.

KEYNOTES

1. FIELD ACCESS TUNNEL (E)
2. RUBBER FLOORING
3. WEIGHT ROOM FLOOR IS 1'-0" LOWER THAN EXISTING FLOOR LEVEL
4. EXTERIOR INSULATED METAL FRAMED CAVITY WALL W/ METAL PANELS, TYP
5. CMU WALLS FOR EQUIPMENT ATTACHMENT AND BALL WALL
7. EXTENT OF METAL CORRUGATED SUBROOF SYSTEM ABOVE NEW ADDITION (DASHED RED LINE) W/ SPRAY FOAM INSULATION ON THE UNDERSIDE OF METAL SUBROOF
8. APPROXIMATE 7'-0" HEAD HEIGHT
11. MICROWAVE
12. SINK
13. DISH WASHER
14. STORAGE CABINETS
15. GLASS
17. LOCKABLE BASE AND WALL CABINETS
59. EXTENT OF UNINSULATED METAL SUBROOF SYSTEM
63. ALIGN FINISH SURFACE
81. SLOPE TO FLOOR DRAIN

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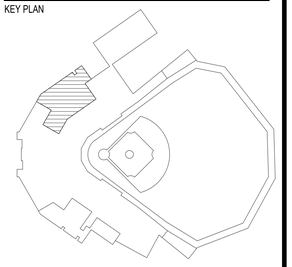

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

HOME CLUBHOUSE PLAN

PHASE CD
DRAWING NO. A2.1.1

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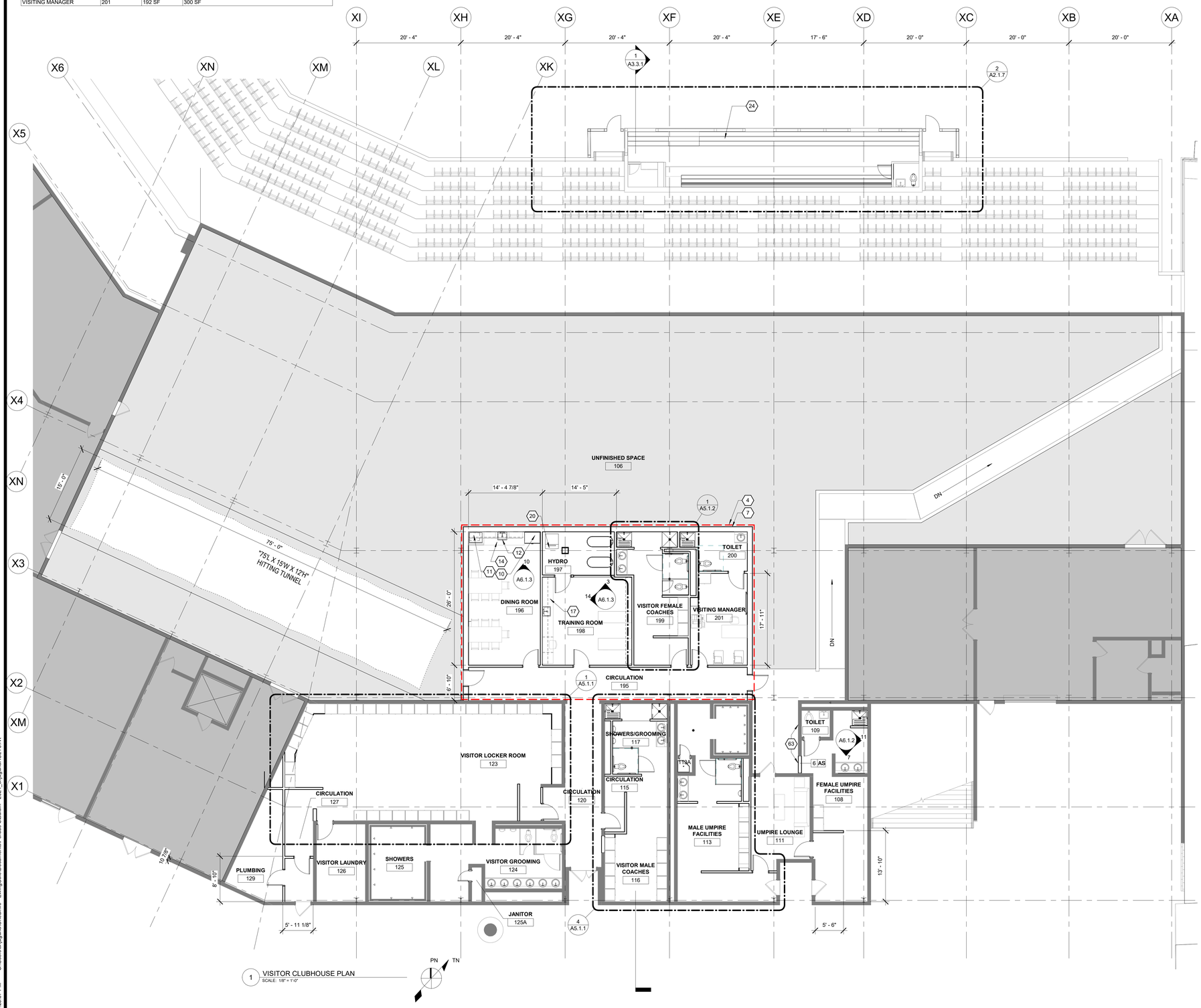
Name	Number	Area	PDL Minimum (SF)
FEMALE UMPIRE FACILITIES	108	373 SF	200 SF
UMPIRE LOUNGE	111	196 SF	N/A
MALE UMPIRE FACILITIES	113	528 SF	200 SF
VISITOR MALE COACHES	116	250 SF	N/A
SHOWERS/GROOMING	117	149 SF	N/A
VISITOR LOCKER ROOM	123	1211 SF	N/A
VISITOR GROOMING	124	311 SF	N/A
SHOWERS	125	171 SF	N/A
JANITOR	125A	13 SF	N/A
VISITOR LAUNDRY	126	143 SF	N/A
PLUMBING	129	157 SF	N/A
DINING ROOM	196	364 SF	300 SF
HYDRO	197	116 SF	300 SF INCLUDES TRAINING RM, OFFICE AND HYDRO
TRAINING ROOM	198	299 SF	300 SF INCLUDES TRAINING RM, OFFICE AND HYDRO
VISITOR FEMALE COACHES	199	269 SF	N/A
TOILET	200	85 SF	N/A
VISITING MANAGER	201	192 SF	300 SF



1 VISITOR CLUBHOUSE PLAN
SCALE: 1/8" = 1'-0"

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
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KEYNOTES

- 4 EXTERIOR INSULATED METAL FRAMED CAVITY WALL W/ METAL PANELS, TYP
- 7 EXTENT OF METAL CORRUGATED SUBROOF SYSTEM ABOVE NEW ADDITION (DASHED RED LINE) W/ SPRAY FOAM INSULATION ON THE UNDERSIDE OF METAL SUBROOF
- 10 REFRIGERATOR/FREEZER
- 11 MICROWAVE
- 12 SINK
- 14 STORAGE CABINETS
- 17 LOCKABLE BASE AND WALL CABINETS
- 20 ICE MACHINE
- 24 NEW RUBBER NON-SKID FLOORING IN DUGOUTS
- 63 ALIGN FINISH SURFACE

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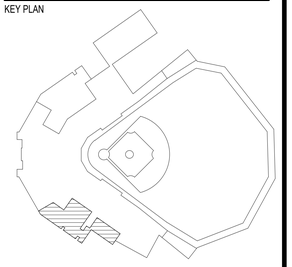

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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DRAWING NAME
VISITOR CLUBHOUSE PLAN

PHASE CD
DRAWING NO. A2.1.2

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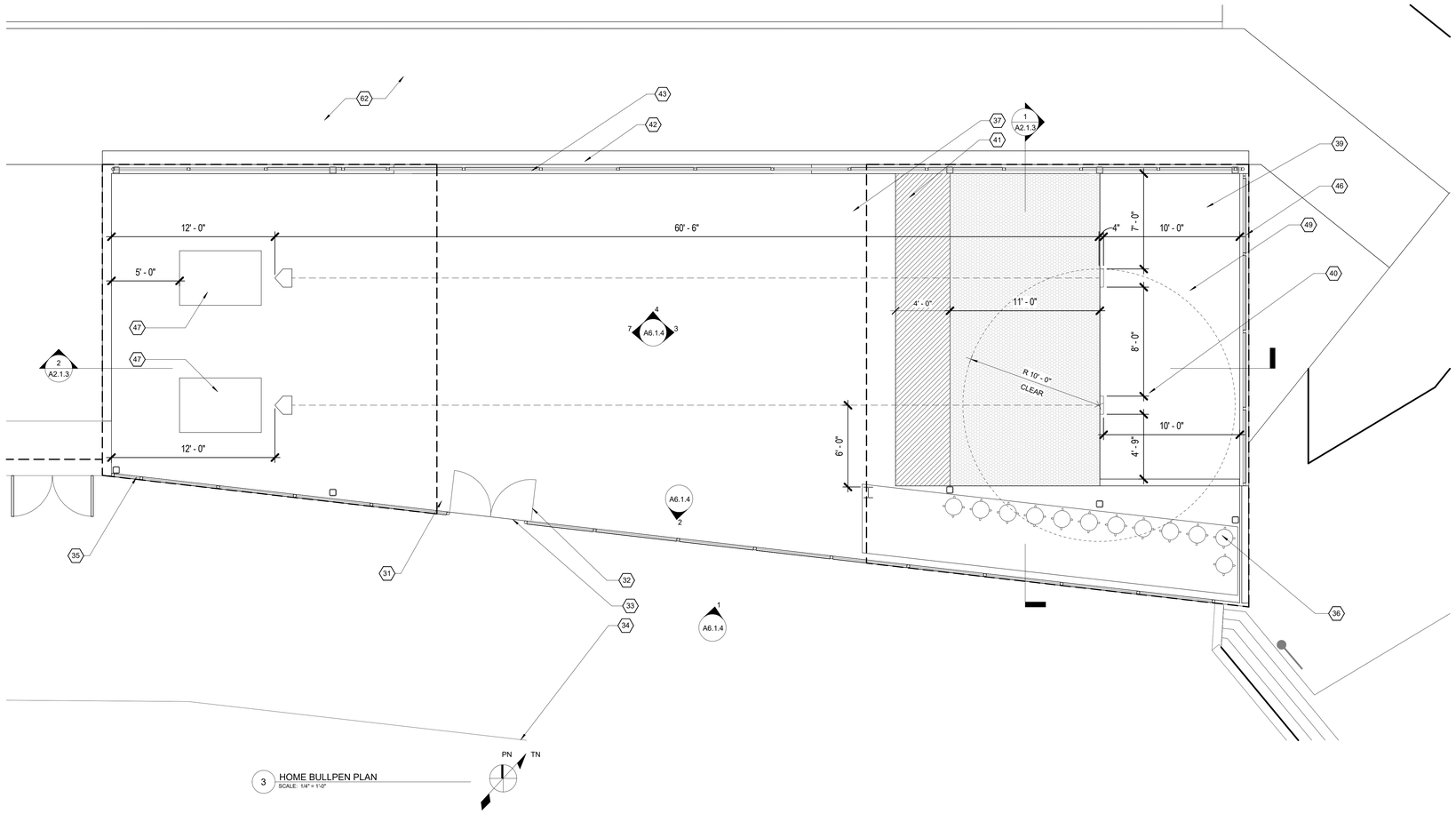
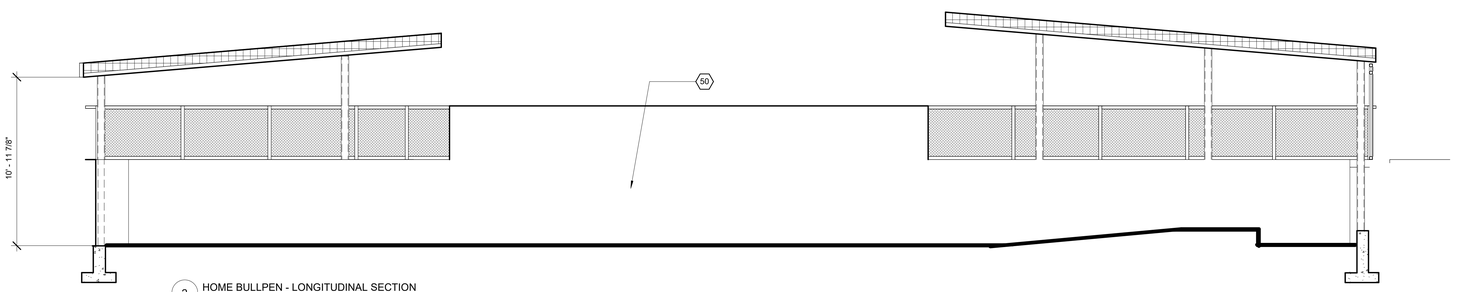
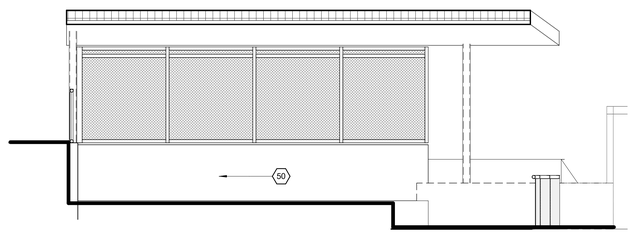


3 HOME BULLPEN PLAN
SCALE: 1/4" = 1'-0"



2 HOME BULLPEN - LONGITUDINAL SECTION
SCALE: 1/4" = 1'-0"



1 HOME BULLPEN - TRANSVERSE SECTION
SCALE: 1/4" = 1'-0"

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KEYNOTES

31	PRE-ENGINEERED METAL CANOPY OVER HOME PLATE
32	SYNTHETIC TURF BULLPEN
33	6'-0" WIDE FIELD ACCESS GATE
34	RESHAPED WARNING TRACK
35	NEW 4'-8" HIGH VINYL COATED CHAINLINK FENCE @ BULLPENS. PADDING ON POSTS AND RAILS (ONLY).
36	INDIVIDUAL BULLPEN BAR HEIGHT STOOLS WITH BACKS ON CONCRETE PAD WITH ANTI-SKID SURFACE TO MATCH DUGOUT. PRE-ENGINEERED METAL CANOPY ABOVE.
37	PRE-ENGINEERED METAL CANOPY OVER PITCHING MOUND
39	SYNTHETIC TURF CONTINUES BEHIND MOUND
40	CLAY PITCHING MOUND W/ CONCRETE CURB
41	RUBBER MAT AT FRONT OF MOUND
42	NEW DRINK RAIL
43	NEW RETAINING WALL W/ 8'-0" H VINYL COATED CHAINLINK FENCE W/ WINDSCREEN
46	NEW RETAINING WALL W/10'-0" H VINYL COATED CHAINLINK FENCE W/ WINDSCREEN
47	REPLACEABLE ZONE OF TURF AT EACH CATCHER POSITION
49	10' MINIMUM CLEAR AT FIELD SIDE MOUND FOR MOTION CAPTURE PORTABLE LAB - PROVIDE (2) SEPERATELY CIRCUITED OUTLETS FOR EQUIPMENT - MIMIMUM
50	NEW RETAINING WALL
62	NEW CONCRETE WALKWAY

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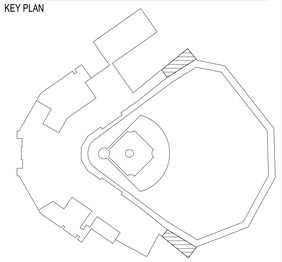

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HOME BULLPEN PLAN

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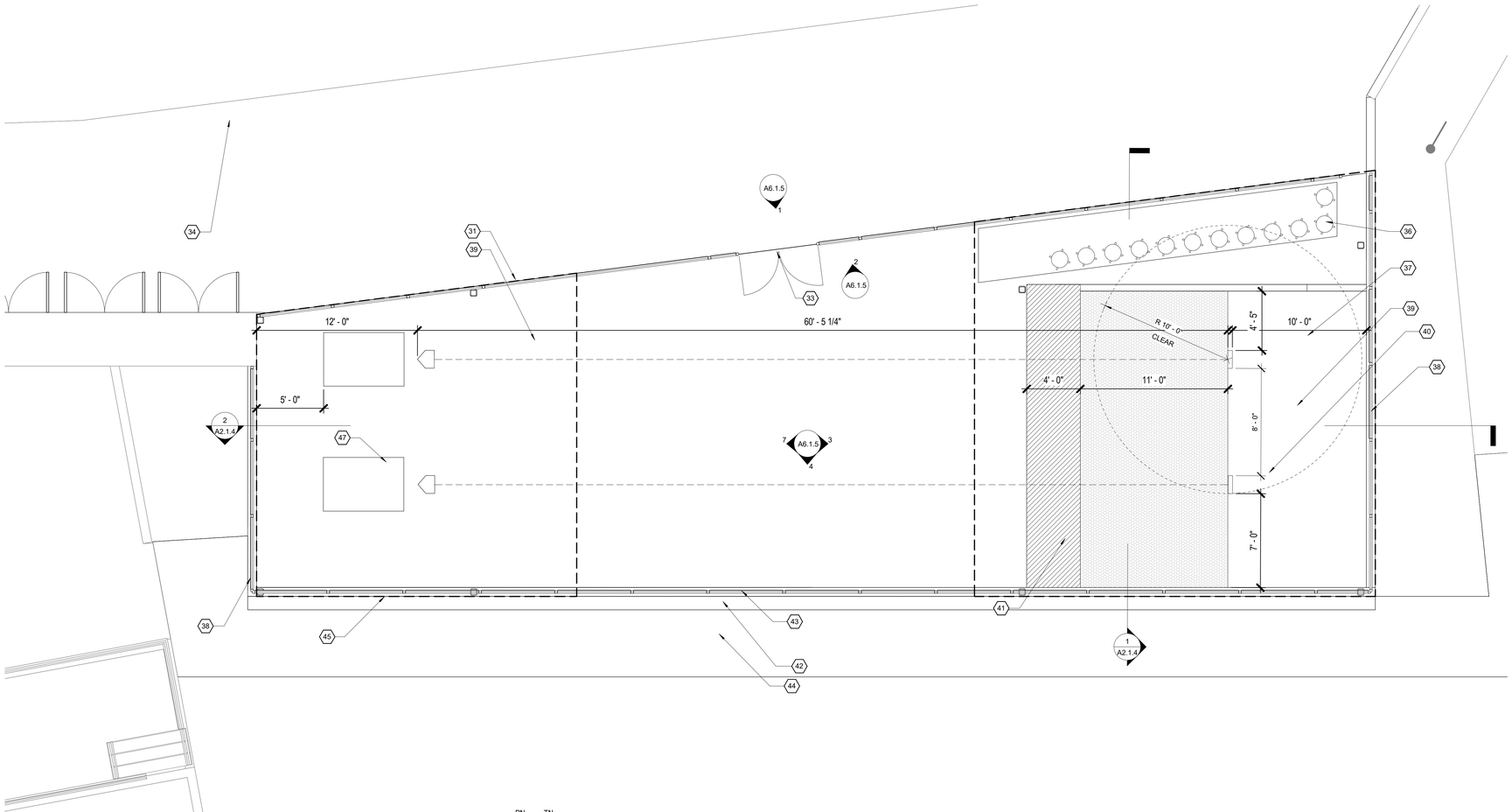
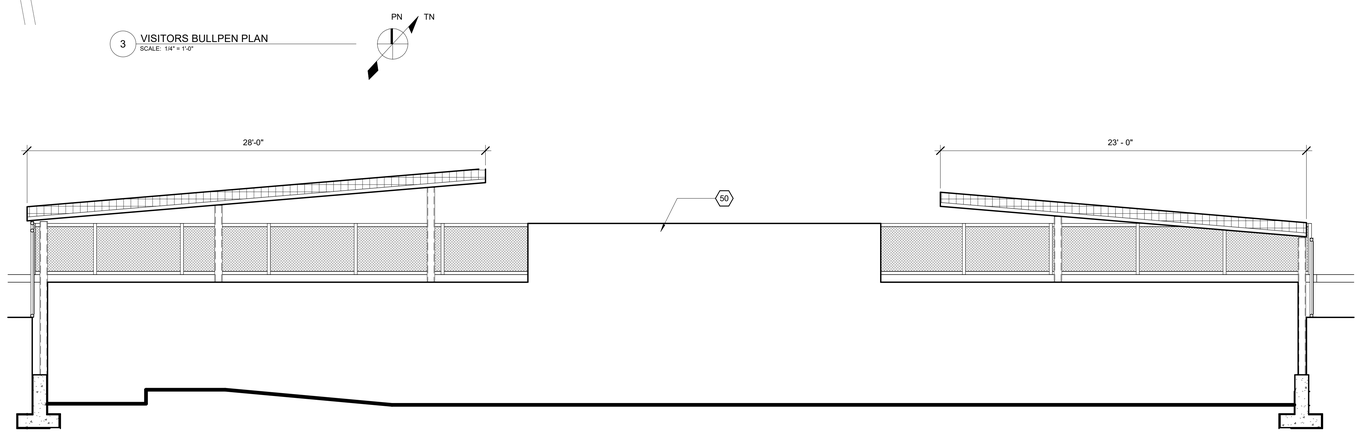


3 VISITORS BULLPEN PLAN
SCALE: 1/4" = 1'-0"



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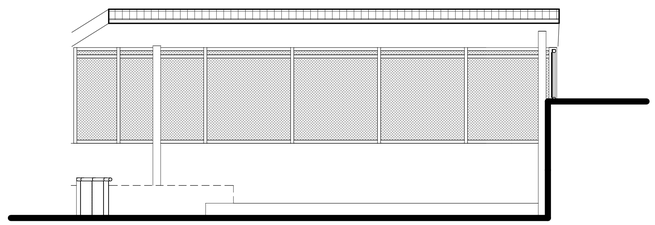

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7. MECHANICAL AND ELECTRICAL DEVICES, FIXTURES, PANELS AND EQUIPMENT INSTALLED IN FINISHED SPACES SHALL BE INSTALLED SO ONLY THE DEVICE, FIXTURE OR EQUIPMENT IS EXPOSED. NO PIPE, DUCT, CONDUIT, WIRE OR OTHER SUCH ELEMENT SHALL BE EXPOSED.
8. PRIOR TO SCHEDULED FINISHING OF EXISTING WALLS, REPAIR MINOR DENTS, IMPERFECTIONS AND SCRAPES.
9. NEW CEILINGS SHALL BE SUSPENDED FROM STRUCTURAL ELEMENTS AND BE INSTALLED PER DIVISION 09 SECTION "DRYWALL SYSTEMS."
10. NEW WALLS SHALL BE ERECTED AS INDICATED AND PER DIVISION 09 SECTION "DRYWALL SYSTEMS."
11. NEW UL RATED WALLS SHALL BE ERECTED BY HOURLY RATING PRIORITY IN DESCENDING ORDER AND SHALL BE ERECTED PRIOR TO NON-RATED WALLS. UL RATED WALLS INTERSECTING EXTERIOR WALLS SHALL BE EXTENDED THROUGH TO THE EXTERIOR SHEATHING. REMOVE EXTERIOR WALL AS REQUIRED TO PROPERLY INSTALL AND REPAIR IN KIND.
12. ROOF SHOULD SLOPE 1/4" TOWARD DRAINS WHERE INDICATED ON ROOF PLAN TYPICALLY.

KEYNOTES

- 31 PRE-ENGINEERED METAL CANOPY OVER HOME PLATE
- 33 6'-0" WIDE FIELD ACCESS GATE
- 34 RESHAPED WARNING TRACK
- 36 INDIVIDUAL BULLPEN BAR HEIGHT STOOLS WITH BACKS ON CONCRETE PAD WITH ANTI-SKID SURFACE TO MATCH DUGOUT. PRE-ENGINEERED METAL CANOPY ABOVE.
- 37 PRE-ENGINEERED METAL CANOPY OVER PITCHING MOUND
- 38 NEW RETAINING WALL W/10'-0" H VINYL COATED CHAINLINK FENCE W/ WINDSCREEN
- 39 SYNTHETIC TURF CONTINUES BEHIND MOUND
- 40 CLAY PITCHING MOUND W/ CONCRETE CURB
- 41 RUBBER MAT AT FRONT OF MOUND
- 42 NEW DRINK RAIL
- 43 NEW RETAINING WALL W/ 8'-0" H VINYL COATED CHAINLINK FENCE W/ WINDSCREEN
- 44 MODIFY EXISTING CONCRETE WALKWAY
- 45 PROVIDE PADDING AT REAR WALL AND ALL COLUMNS, TYPICAL
- 47 REPLACEABLE ZONE OF TURF AT EACH CATCHER POSITION
- 50 NEW RETAINING WALL

MARYLAND STADIUM AUTHORITY
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McCRONE ENGINEERING

MEPFP ENGINEERS
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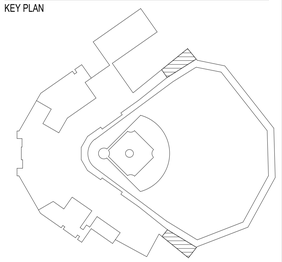
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME

VISITOR BULLPEN PLAN

PHASE CD
DRAWING NO. A2.1.4

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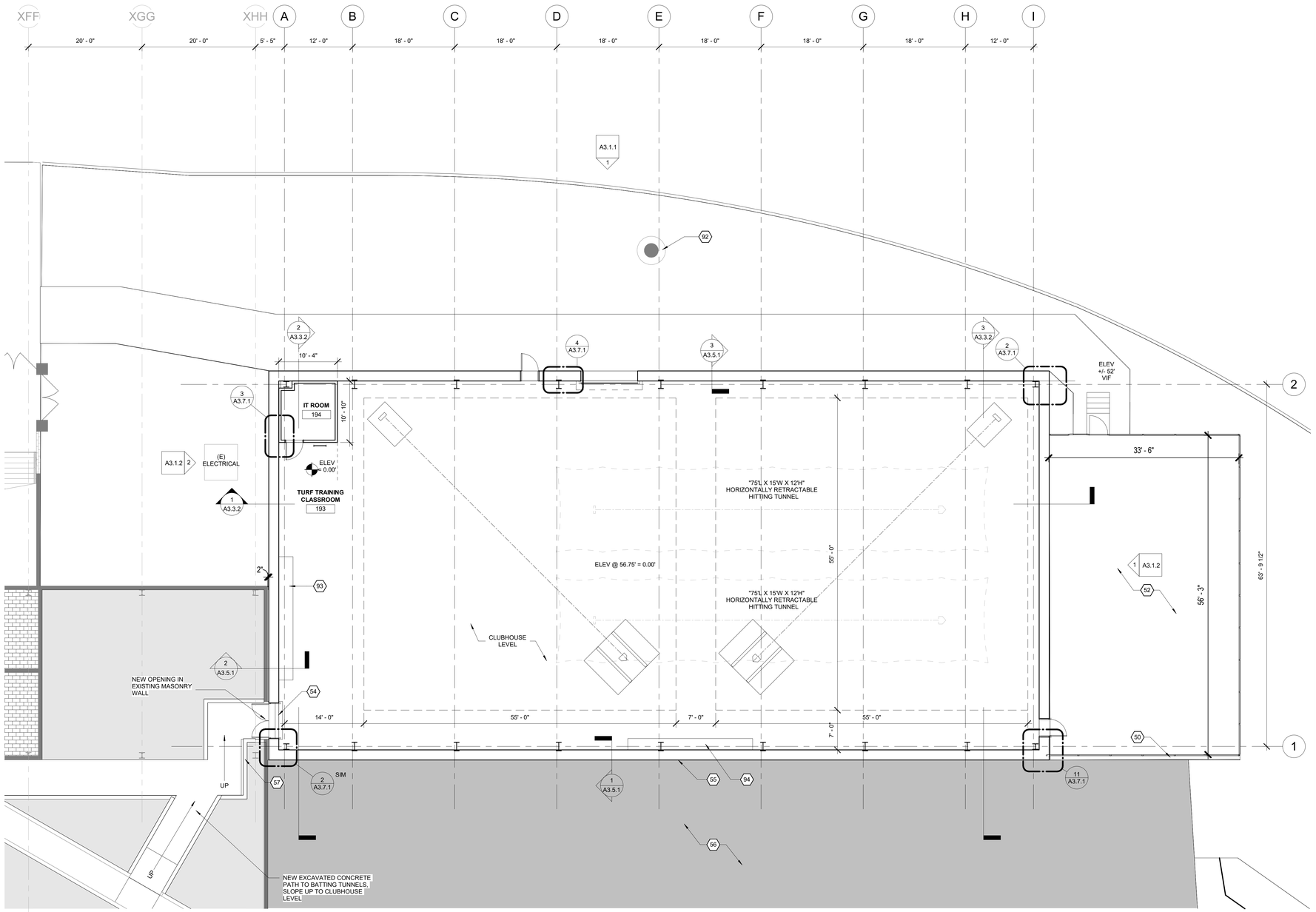
Name	Number	Area	PDL Minimum (SF)
SHARED BATTING TUNNELS	192	Redundant Room	3240 SF
TURF TRAINING CLASSROOM	193	8544 SF	N/A
IT ROOM	194	92 SF	N/A



2 HOME CLUBHOUSE BATTING TUNNEL ADDITION FLOOR PLAN
SCALE: 1/8" = 1'-0"

PN TN

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

GENERAL NOTES

1. ALL INTERIOR PARTITIONS SHOULD BE WALL TYPE 2BS UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND POSTING ALL REQUIRED LOCAL AND STATE CONSTRUCTION PERMITS.
3. VERIFY ALL EXISTING FIELD CONDITIONS ARE CONSISTENT WITH THE DOCUMENTS BEFORE PROCEEDING. REPORT INCONSISTENCIES TO THE ARCHITECT.
4. ACCESS TO AREAS OUTSIDE THE PROJECT AREA LINE SHALL BE COORDINATED IN ADVANCE WITH THE OWNER.
5. ALL UTILITY SHUT DOWNS OR SUSPENSION OF MECHANICAL OR ELECTRICAL SERVICES SHALL BE SCHEDULED IN ADVANCE WITH THE OWNER.
6. UNLESS OTHERWISE NOTED ON DOCUMENTS, ALL PAINTING SHALL BE FROM A CORNER TO A CORNER AND CEILING TO FLOOR REGARDLESS OF AREA ACTUALLY DISTURBED.
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12. ROOF SHOULD SLOPE 1/4" TOWARD DRAINS WHERE INDICATED ON ROOF PLAN TYPICALLY.

KEYNOTES

- 50 NEW RETAINING WALL
- 52 OUTSIDE TURF AREA
- 54 NEW OPENING IN EXISTING MASONRY WALL
- 55 SHORE CONCOURSE SLAB
- 56 EXISTING SLAB AT CONCOURSE LEVEL
- 57 COORDINATE WITH UTILITIES IN THIS AREA
- 92 EXISTING FIELD LIGHT
- 93 12" WORK COUNTER BELOW SCREENS
- 94 BUILT IN LOCKABLE EQUIPMENT LOCKER

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KEY PLAN

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A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME

BATTING ARENA PLAN

PHASE CD

DRAWING NO. A2.1.5

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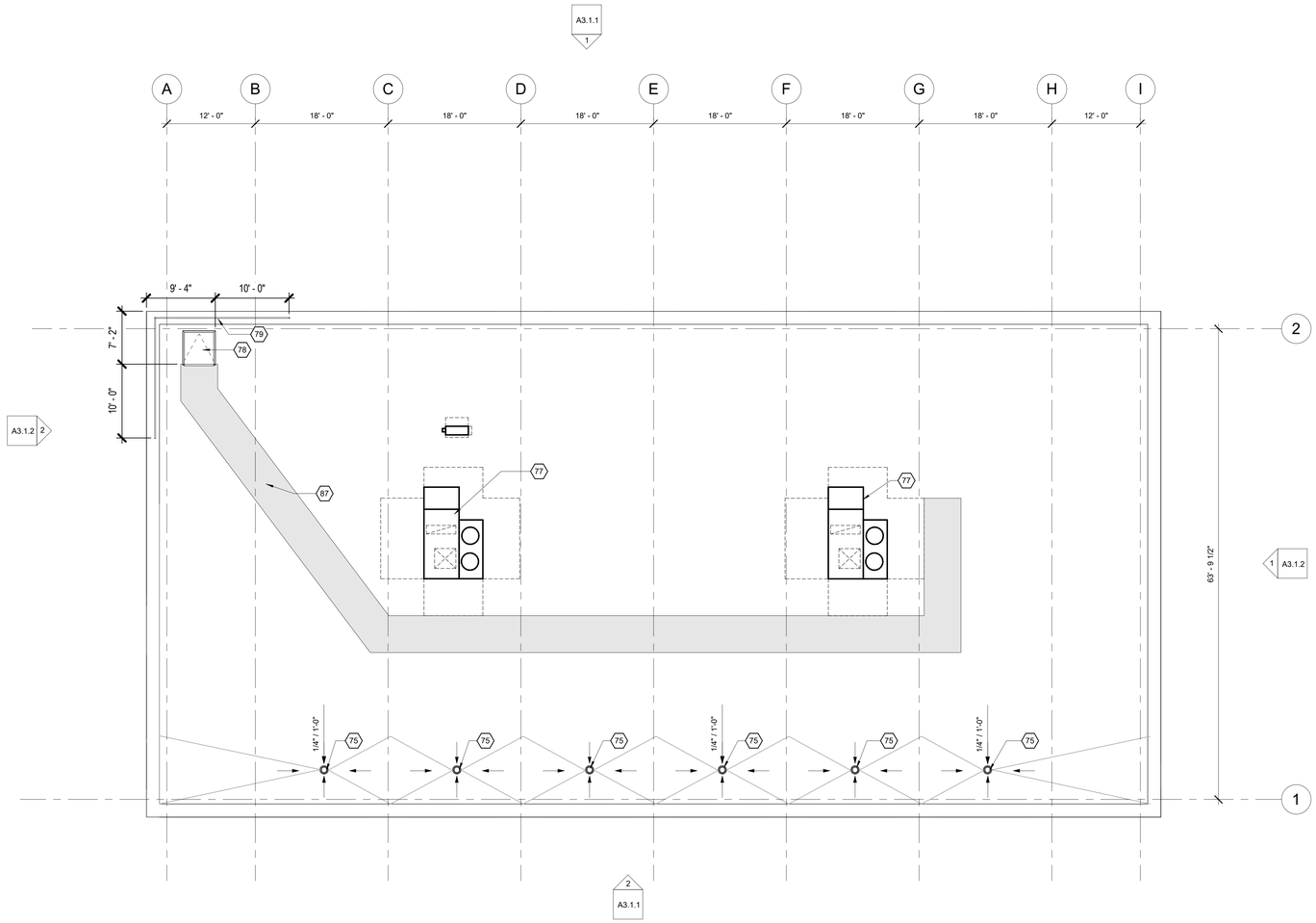

1 BATTING ARENA ROOF
SCALE: 1/8" = 1'-0"

PN TN

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
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KEYNOTES

- 75 ROOF DRAIN
- 77 ROOF TOP UNIT
- 78 ROOF HATCH
- 79 SAFETY RAIL
- 87 ROOF WALKWAY PAD

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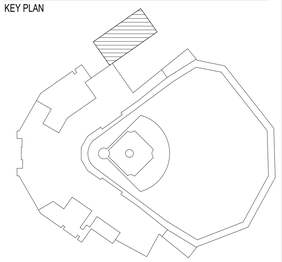

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Project Architect
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Project Model Lead
SN

REVISIONS

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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

BATTING ARENA ROOF PLAN

PHASE
CD

DRAWING NO.
A2.1.6

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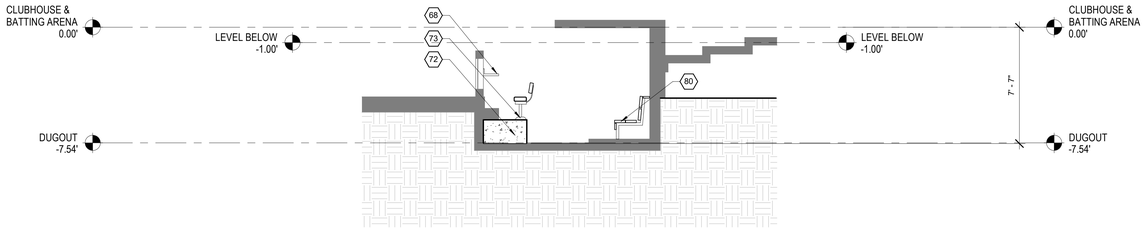
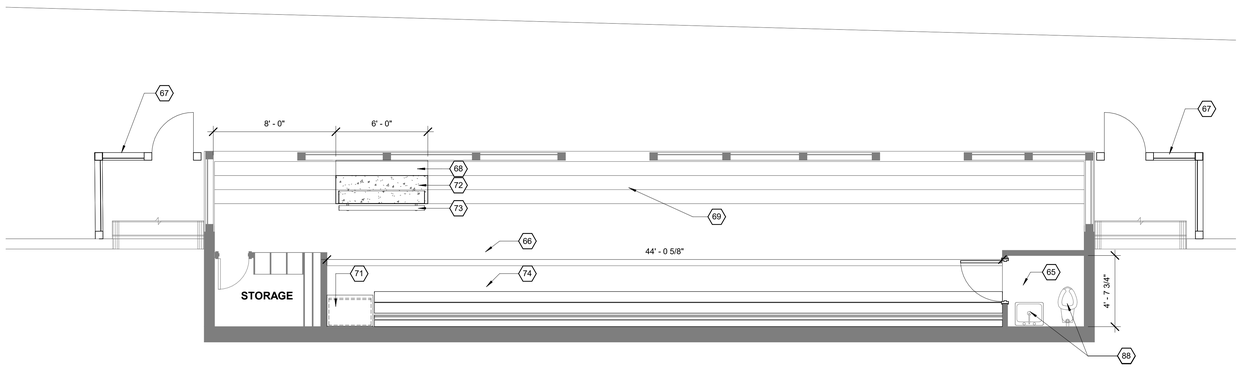
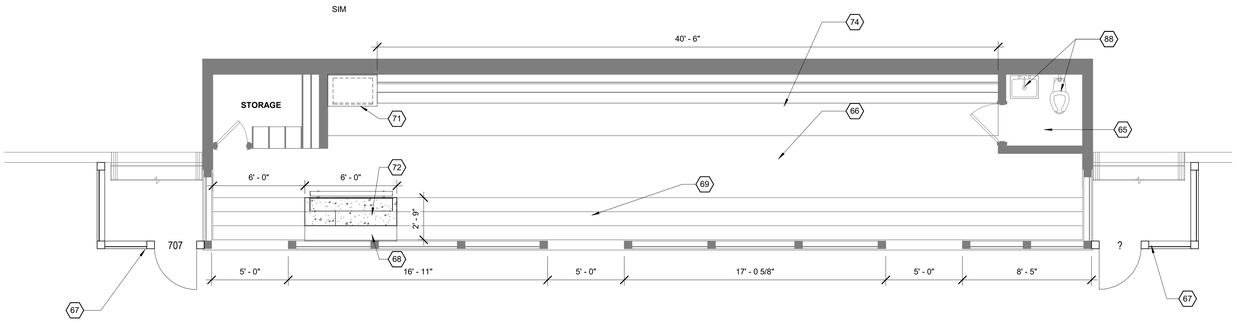


3 ENLARGED BUILDING SECTION - DUGOUT
SCALE: 1/4" = 1'-0"



2 VISITOR DUGOUT PLAN
SCALE: 1/4" = 1'-0"

PN TN



1 HOME DUGOUT PLAN
SCALE: 1/4" = 1'-0"

PN TN

KEYNOTES

65	SLOPE FLOOR TO DRAIN
66	INCREASE DUGOUT GRATE SIZE
67	EXTEND DUGOUT FENCING TO ENCLOSE EXISTING STAIRS, PROVIDE NEW LATCHABLE GATE AND FULL PDL COMPLIANT PADDING
68	ADD TABLE FOR COACHES ITEMS
69	NEW ANTI SKID FLOOR COATING AT ALL DUGOUT STEPS
71	NEW TABLE FOR COOLERS
72	NEW CONCRETE PLATFORM
73	NEW BENCH
74	ADD DUGOUT HEATERS
80	EXISTING BENCH
88	NEW PLUMBING FIXTURES @ EXISTING LOCATIONS

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MEPFP ENGINEERS
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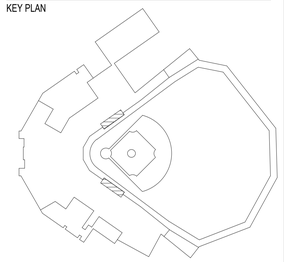

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Project Architect
SN
Project Model Lead
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REVISIONS

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME
HOME & VISITOR DUGOUT PLANS & SECTION

PHASE CD

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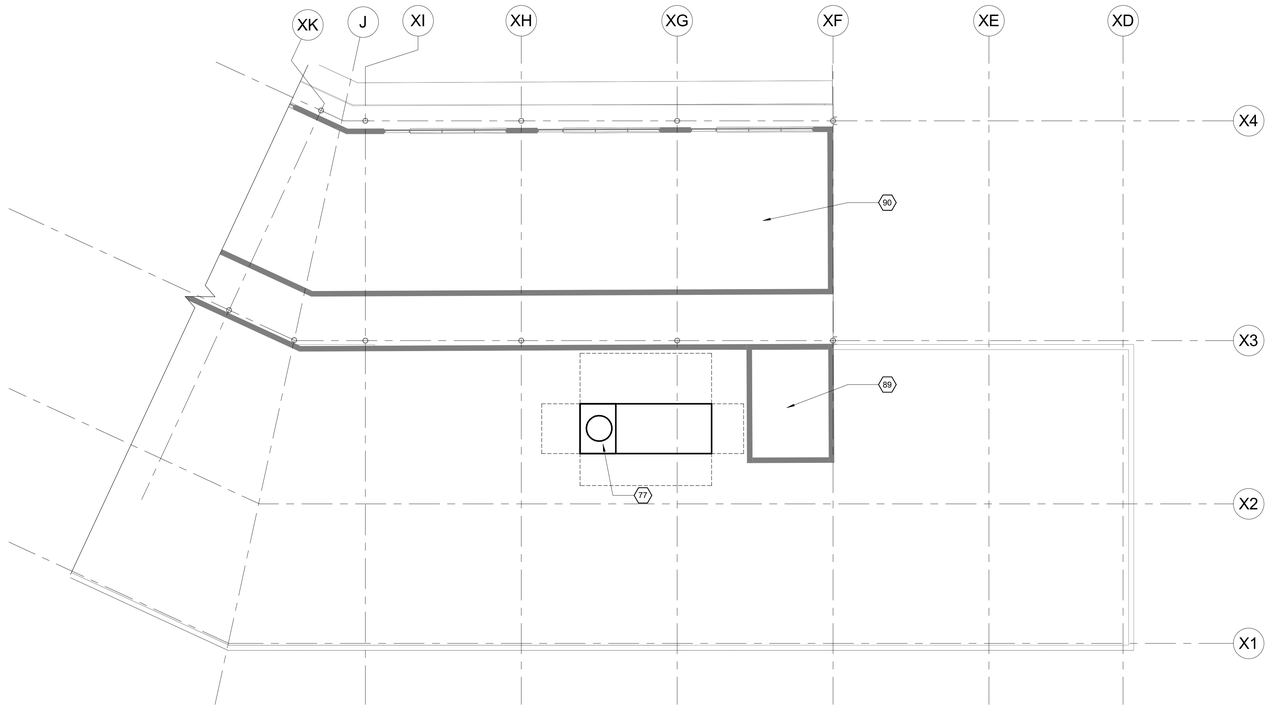
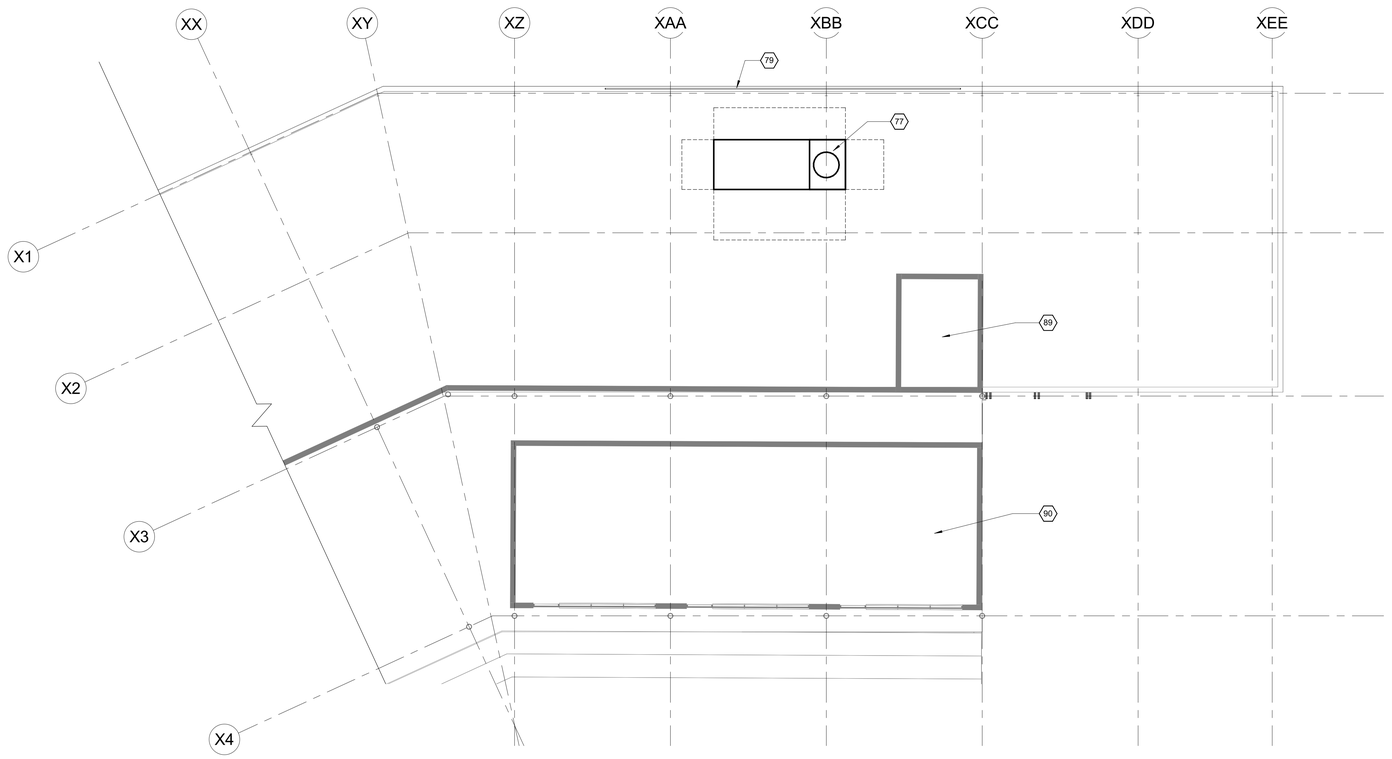


2 VISITOR CLUBHOUSE PARTIAL ROOF PLAN
SCALE: 1/8" = 1'-0"

PN TN



1 HOME CLUBHOUSE PARTIAL ROOF PLAN A
SCALE: 1/8" = 1'-0"

PN TN

KEYNOTES

77	ROOF TOP UNIT
79	SAFETY RAIL
89	EXISTING STAIR
90	EXISTING SKYBOXES

MARYLAND STADIUM AUTHORITY
351 West Camden Street
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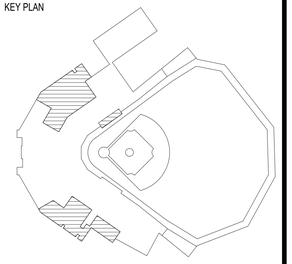
MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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TR
Project Architect
SN
Project Model Lead
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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME
HOME & VISITOR PARTIAL ROOF PLANS

PHASE CD

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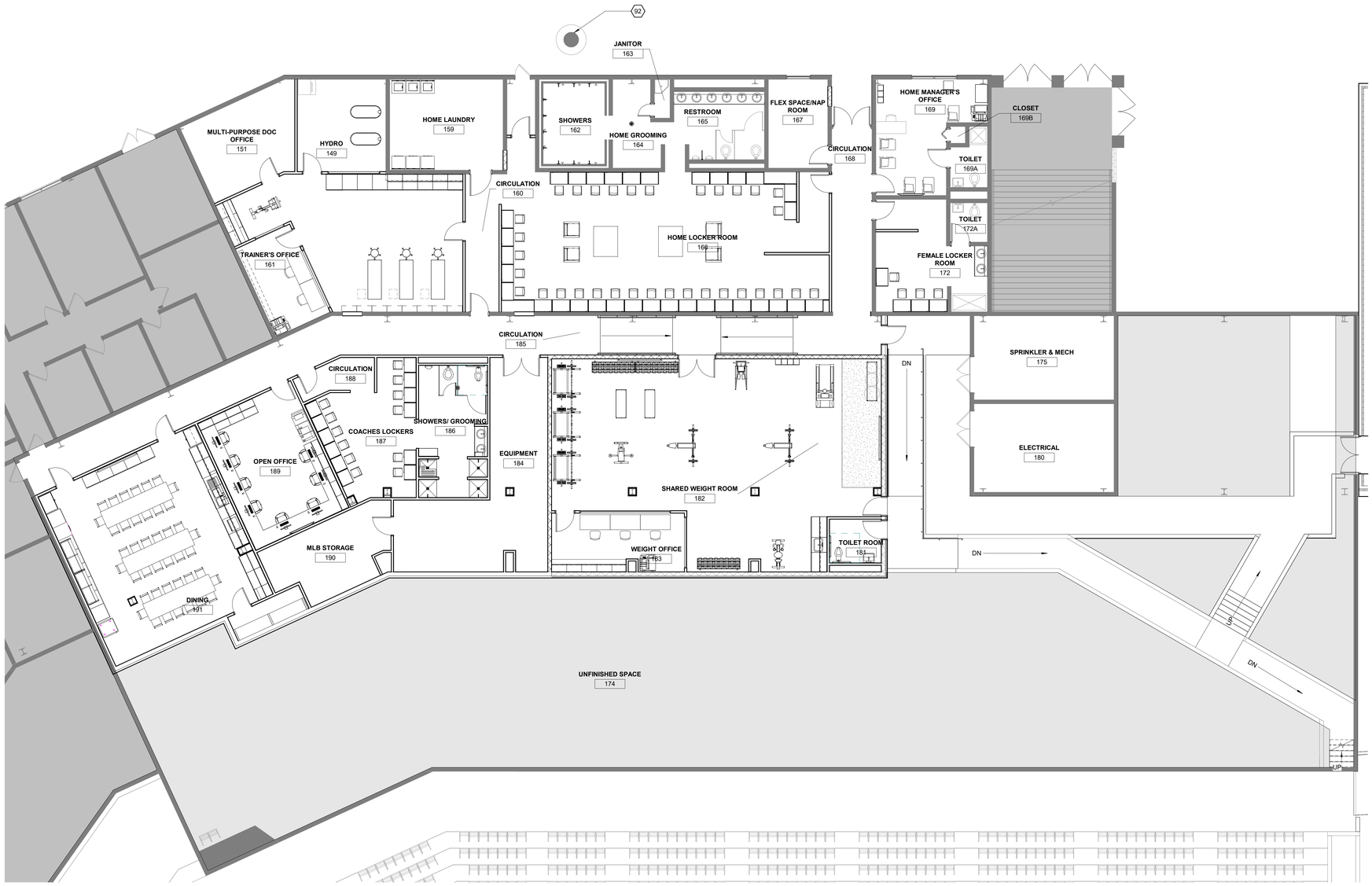

1 HOME CLUBHOUSE FURNITURE PLAN
SCALE: 1/8" = 1'-0"

PN TN

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

GENERAL NOTES

1. ALL CLUBHOUSE AREAS ARE TO RECEIVE NEW FINISHES, PLUMBING AND LIGHTING FIXTURES

KEYNOTES

92 EXISTING FIELD LIGHT

MARYLAND STADIUM AUTHORITY
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

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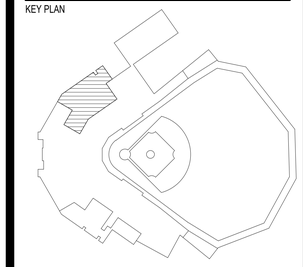

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A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE FURNITURE PLAN

PHASE CD

DRAWING NO. A2.3.1

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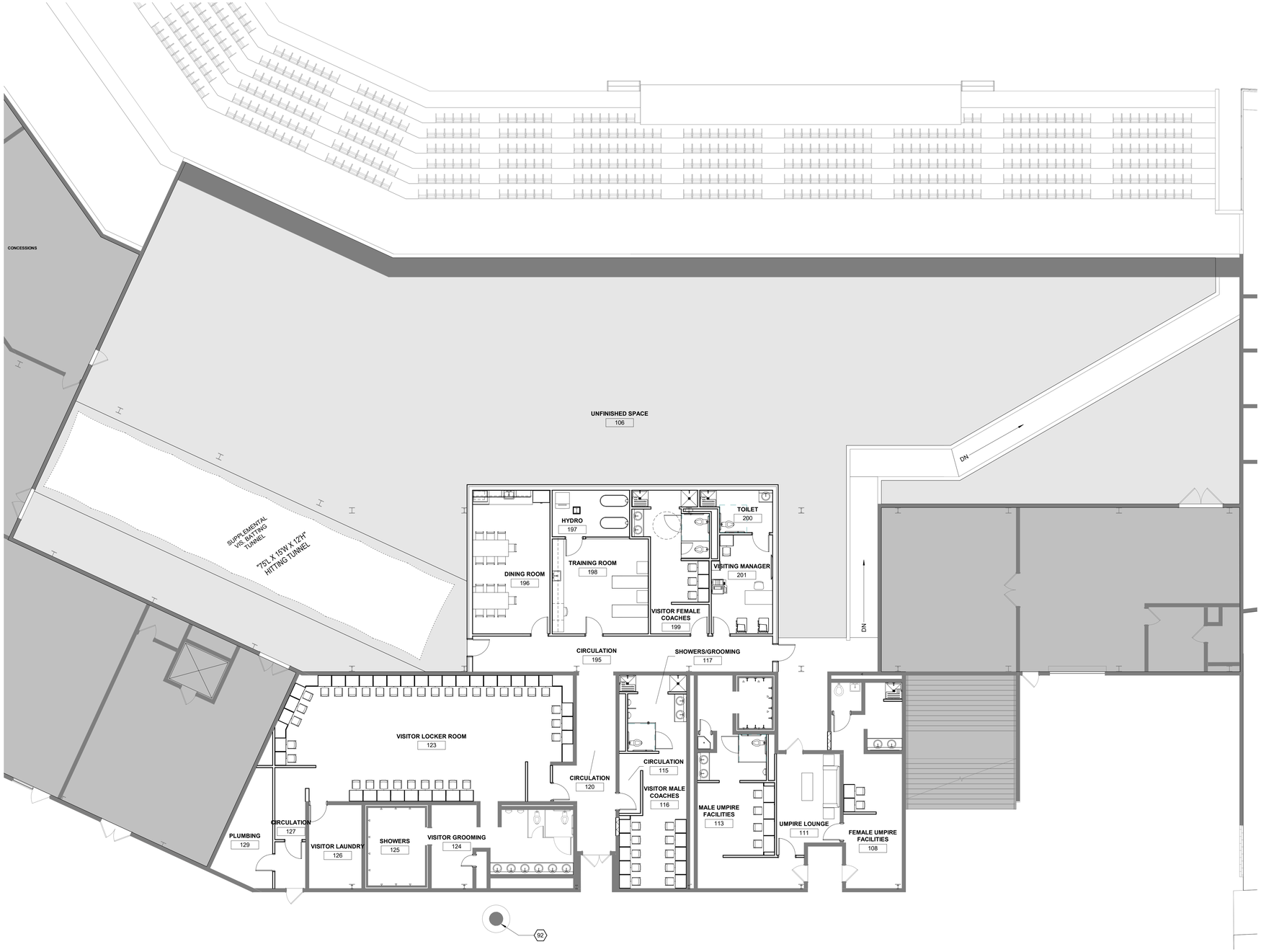

1 VISITOR CLUBHOUSE FURNITURE PLAN
SCALE: 1/8" = 1'-0"

PN TN

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

GENERAL NOTES

1. ALL CLUBHOUSE AREAS ARE TO RECEIVE NEW FINISHES, PLUMBING AND LIGHTING FIXTURES

KEYNOTES

92 EXISTING FIELD LIGHT

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Est. 1986
351 West Camden Street
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Baltimore, MD 21201
Tel: 410-333 1560

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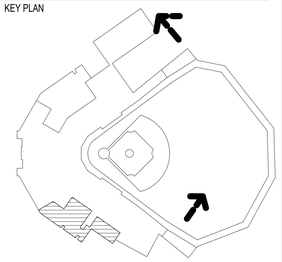

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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME
VISITOR CLUBHOUSE FURNITURE PLAN

PHASE CD
DRAWING NO. A2.3.2

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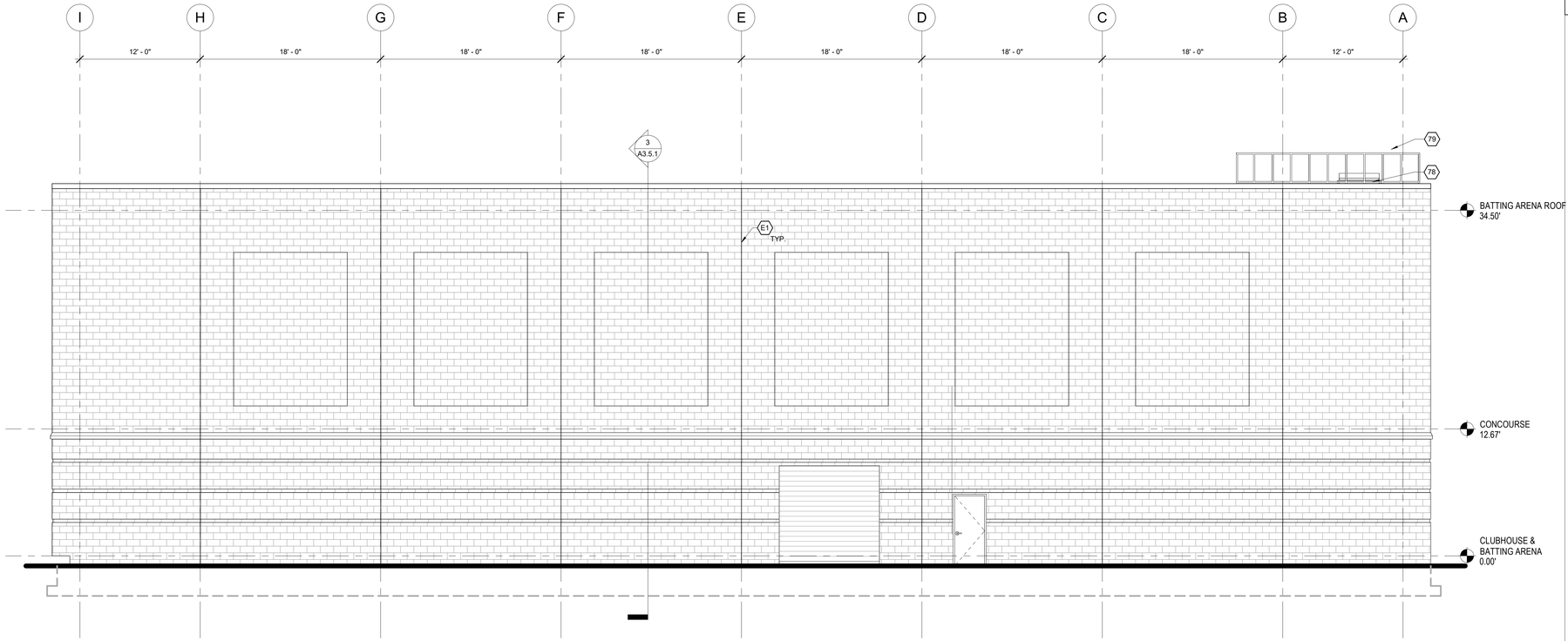
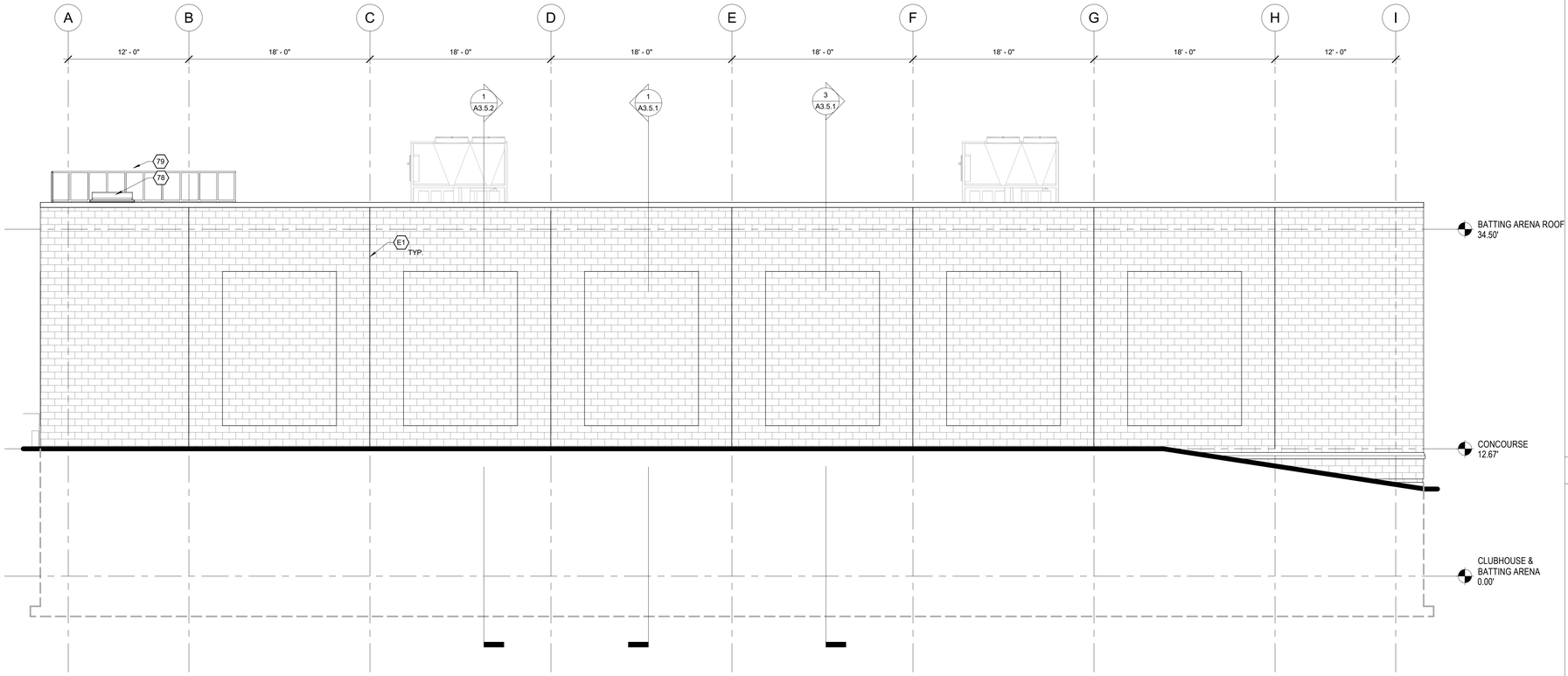


1 BATTING ARENA - NORTH ELEVATION
SCALE: 3/16" = 1'-0"



2 BATTING ARENA - SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

GENERAL NOTES

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2. THE CONTRACTOR SHALL CONFIRM AND COORDINATE ALL CIVIL, STRUCTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING WORK INDICATED ON ELEVATIONS.
3. REFER TO MECHANICAL ELECTRICAL, AND PLUMBING, AND FIRE PROTECTION DRAWINGS FOR ANY EQUIPMENT SHOWN ON EXTERIOR ELEVATIONS. THE FINAL LOCATION OF ALL EXTERIOR LIGHTING SHALL BE COORDINATED WITH ARCHITECT.
4. DIMENSIONS SHOWN FOR METAL WALL PANELS ARE TO THE CENTERLINE OF THE METAL PANEL REVEALS.
5. ALL MEP PENETRATIONS THROUGH EXTERIOR WALLS TO BE SEALED WATERTIGHT WITH BACKER ROD AND SEALANT, TYP.

KEYNOTES

78	ROOF HATCH
79	SAFETY RAIL
E1	CONTROL JOINT

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

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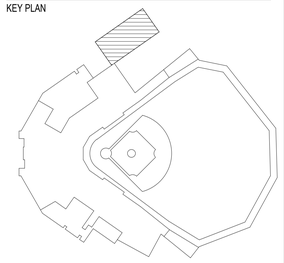
MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME
EXTERIOR ELEVATIONS

PHASE CD
DRAWING NO. A3.1.1

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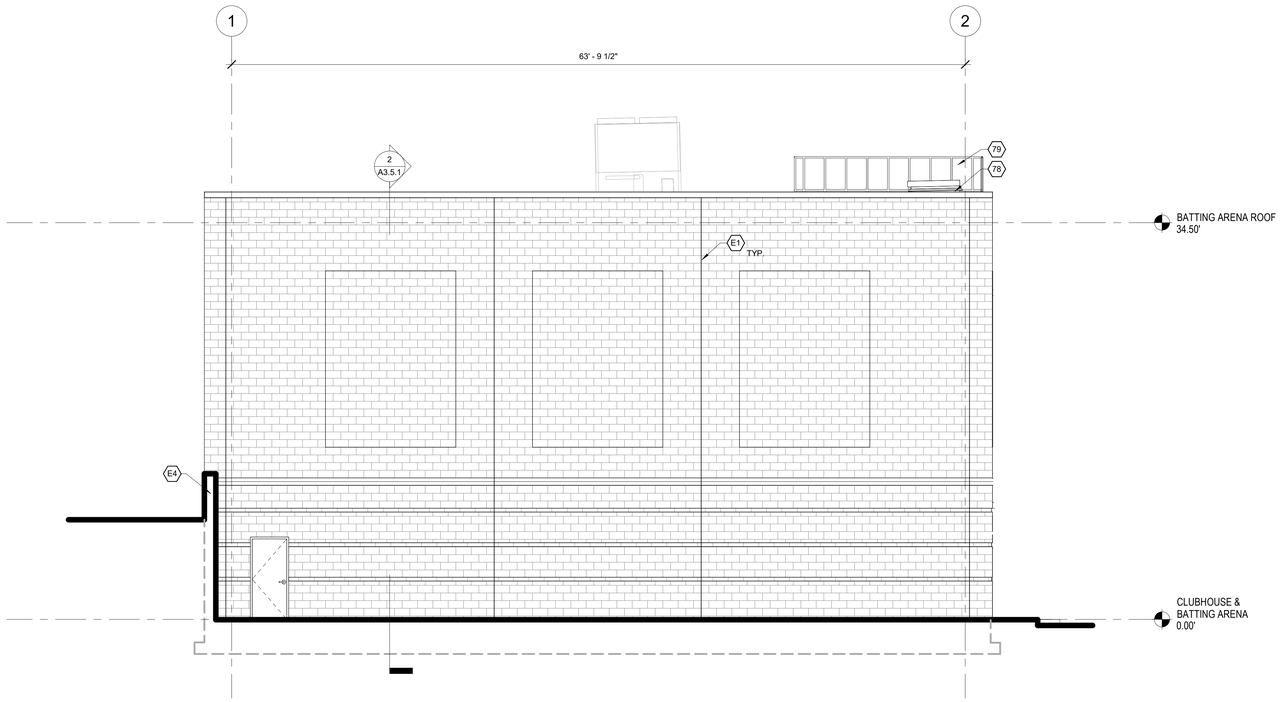
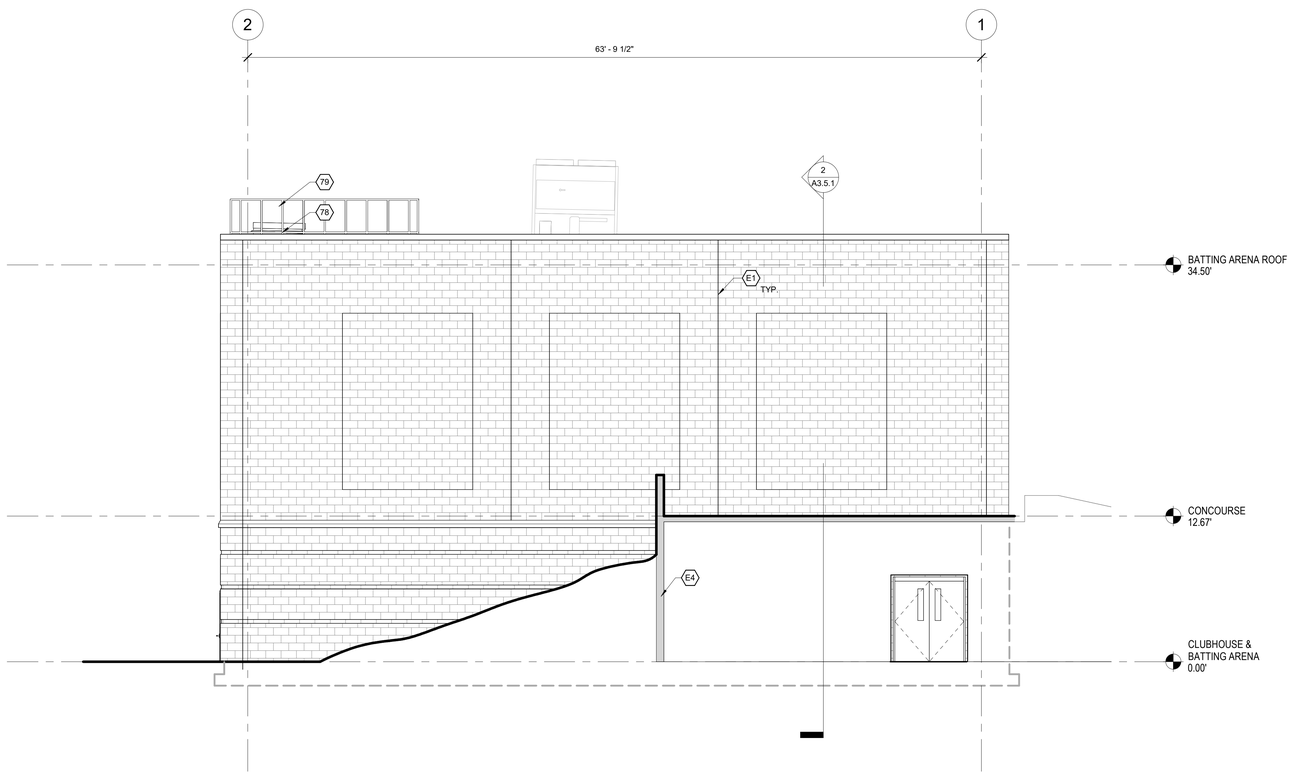


1 BATTING ARENA - WEST ELEVATION
SCALE: 3/16" = 1'-0"



2 BATTING ARENA - EAST ELEVATION
SCALE: 3/16" = 1'-0"

GENERAL NOTES

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KEYNOTES

- 78 ROOF HATCH
- 79 SAFETY RAIL
- E1 CONTROL JOINT
- E4 RETAINING WALL

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CONVERGENT TECHNOLOGIES DESIGN GROUP

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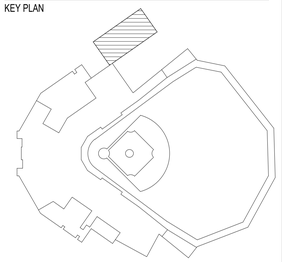

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME

EXTERIOR ELEVATIONS

PHASE CD
DRAWING NO. A3.1.2

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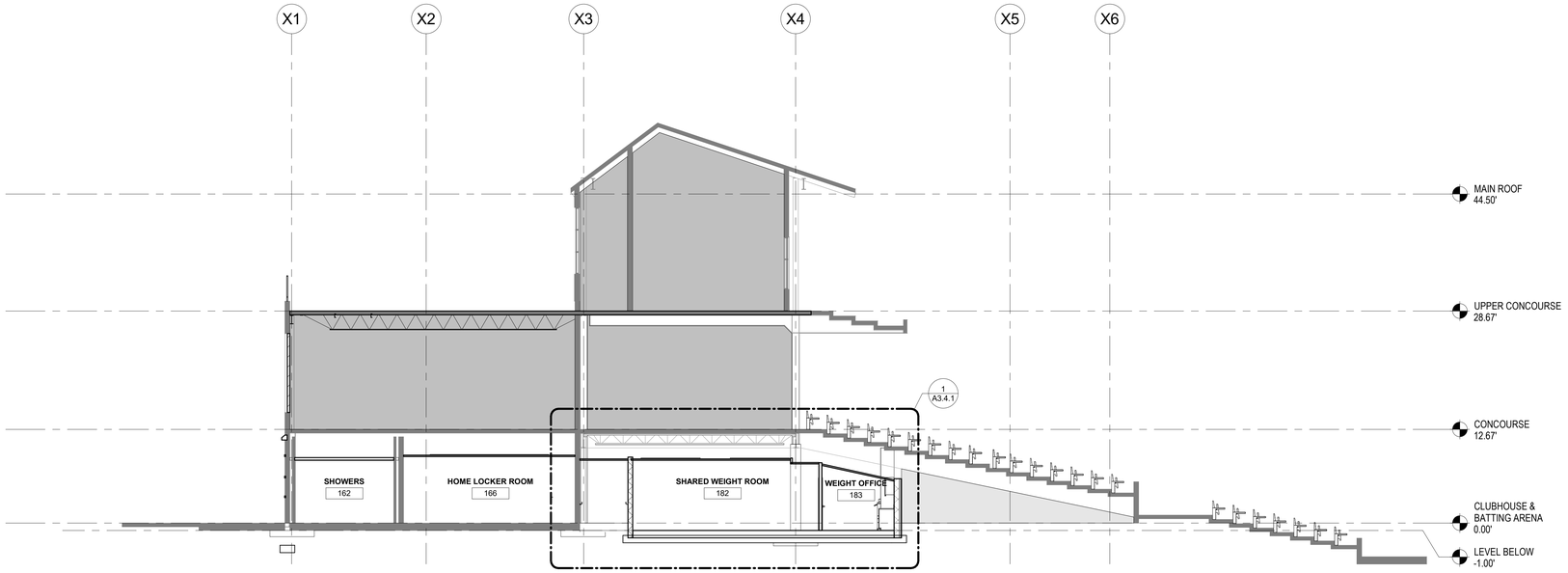
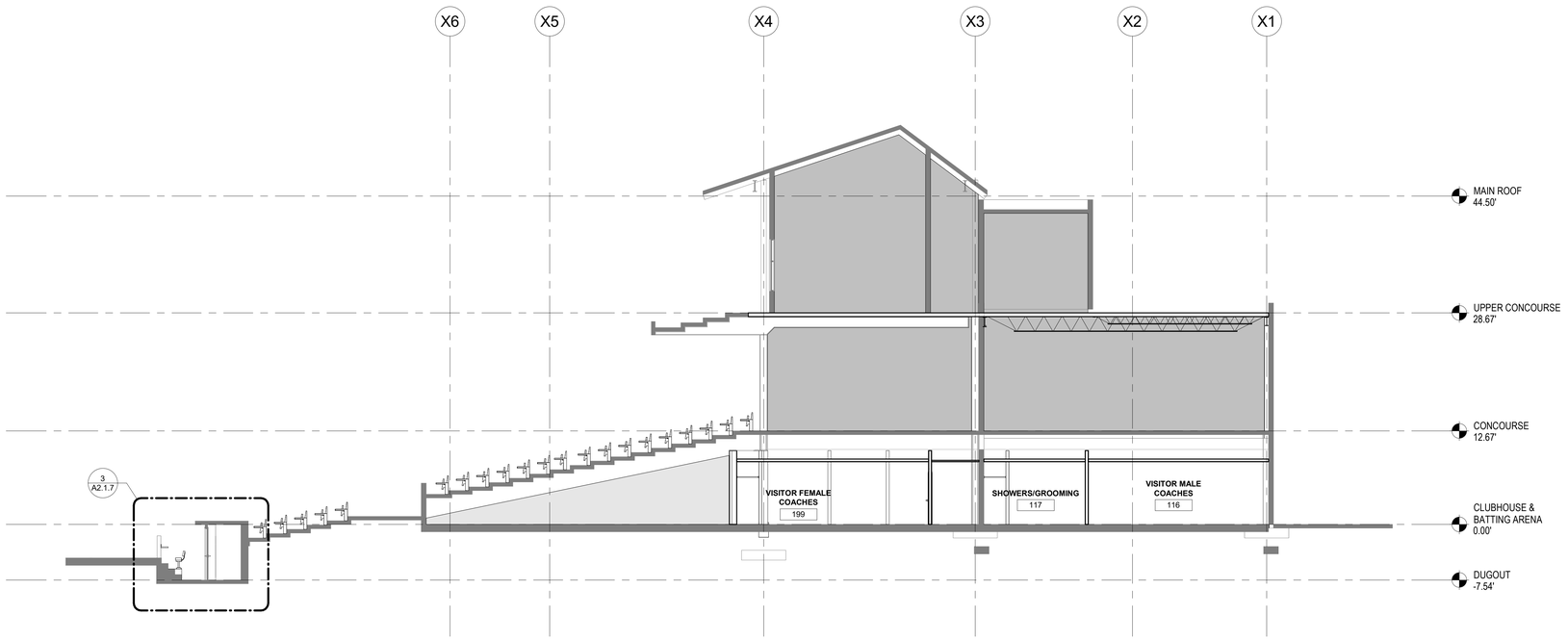


2 HOME CLUBHOUSE SECTION
SCALE: 1/8" = 1'-0"



1 VISITOR CLUBHOUSE SECTION
SCALE: 1/8" = 1'-0"

LEGEND

SECTION LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

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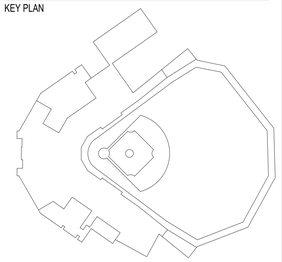

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME
BUILDING SECTIONS

PHASE
CD
DRAWING NO.
A3.3.1

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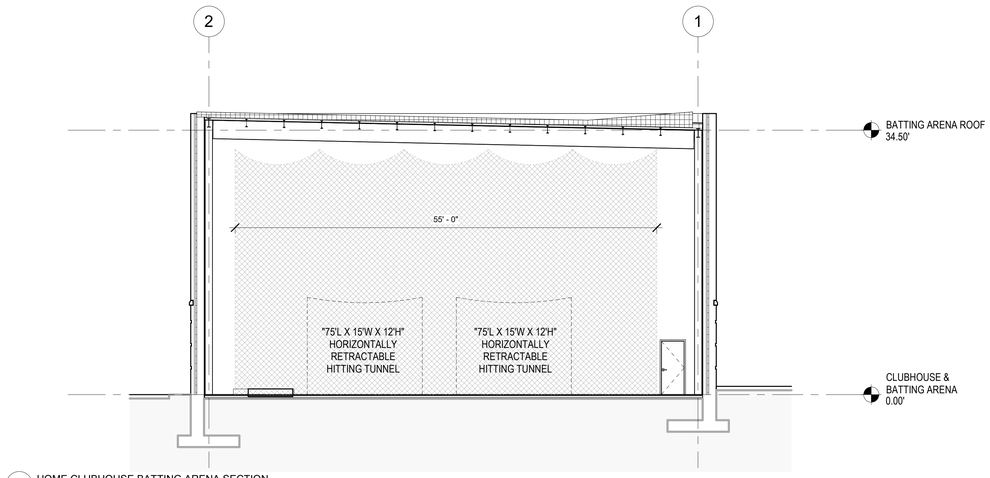
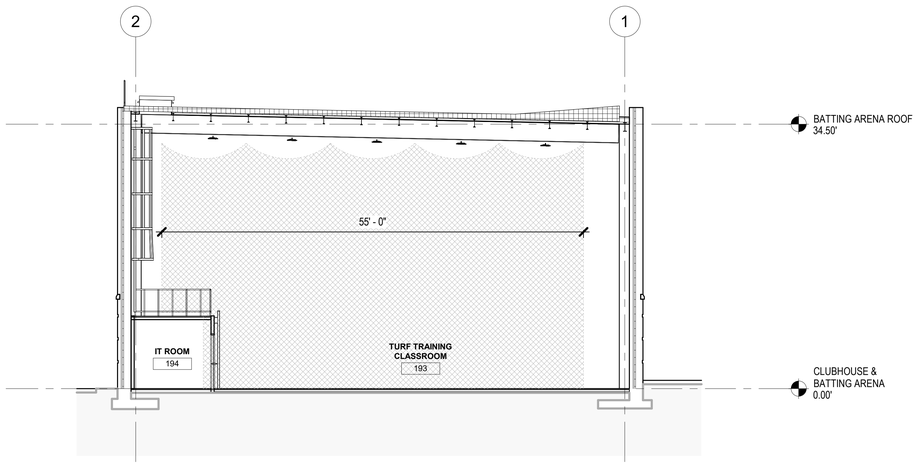
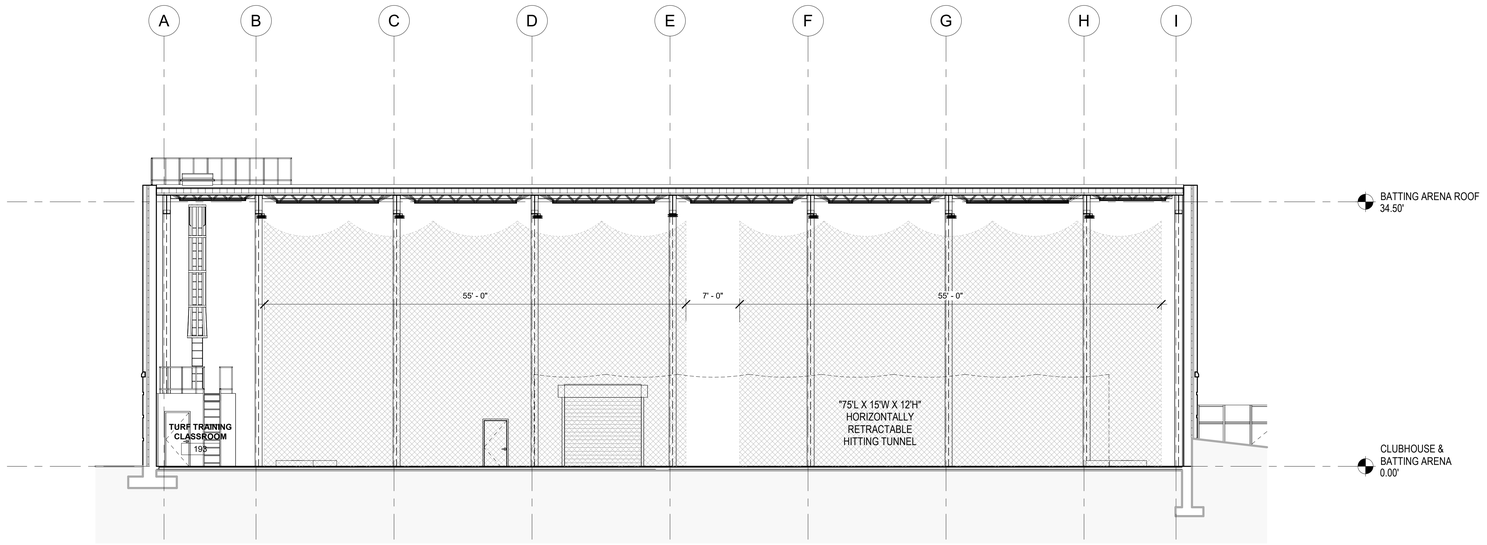


3 HOME CLUBHOUSE BATTING ARENA SECTION
SCALE: 1/8" = 1'-0"



2 TURF TRAINING/ CLASSROOM SECTION
SCALE: 1/8" = 1'-0"



1 HOME CLUBHOUSE BATTING TUNNEL SECTION
SCALE: 1/8" = 1'-0"

LEGEND

SECTION LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

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WFT ENGINEERING, INC

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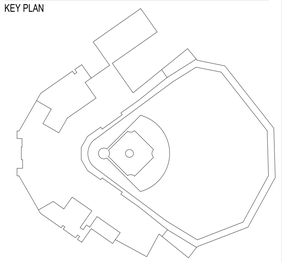
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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Project Architect
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Project Model Lead
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME
BUILDING SECTIONS

PHASE
CD
DRAWING NO.
A3.3.2

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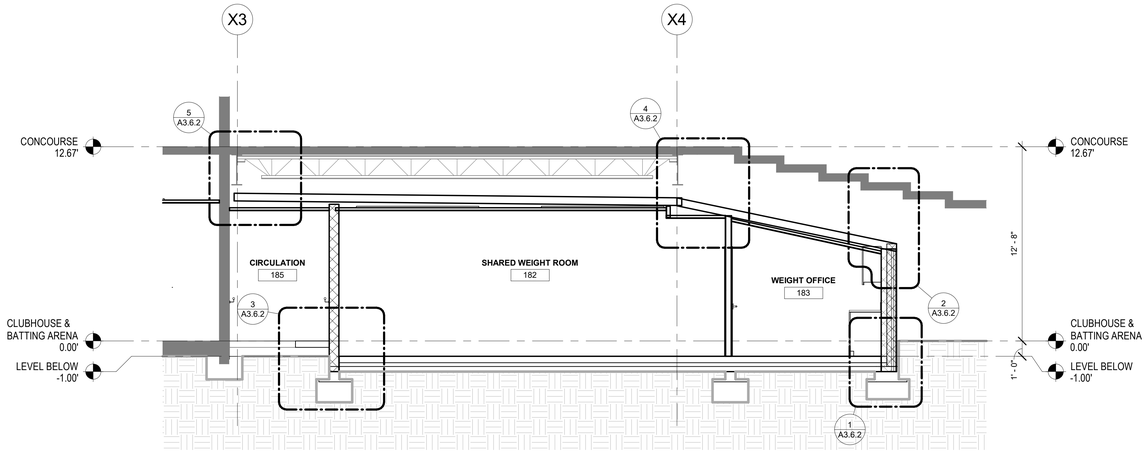

1 ENLARGED BUILDING SECTION - WEIGHT ROOM
SCALE: 1/4" = 1'-0"

LEGEND

SECTION LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- N.I.C. (NOT IN CONTRACT)
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KEYNOTES

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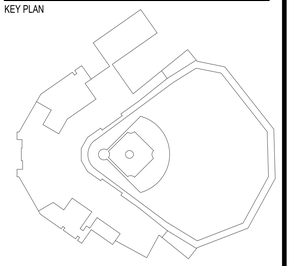
KEY PLAN



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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME
ENLARGED BUILDING SECTIONS

PHASE CD
DRAWING NO. A3.4.1

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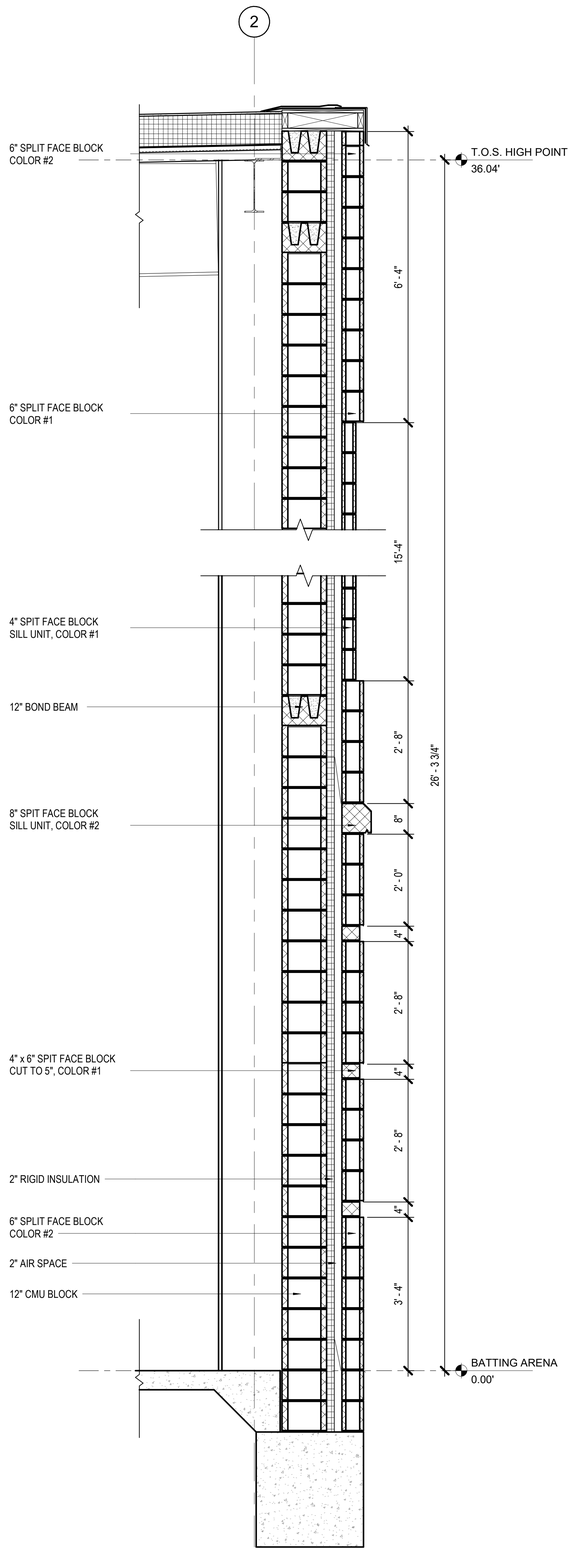
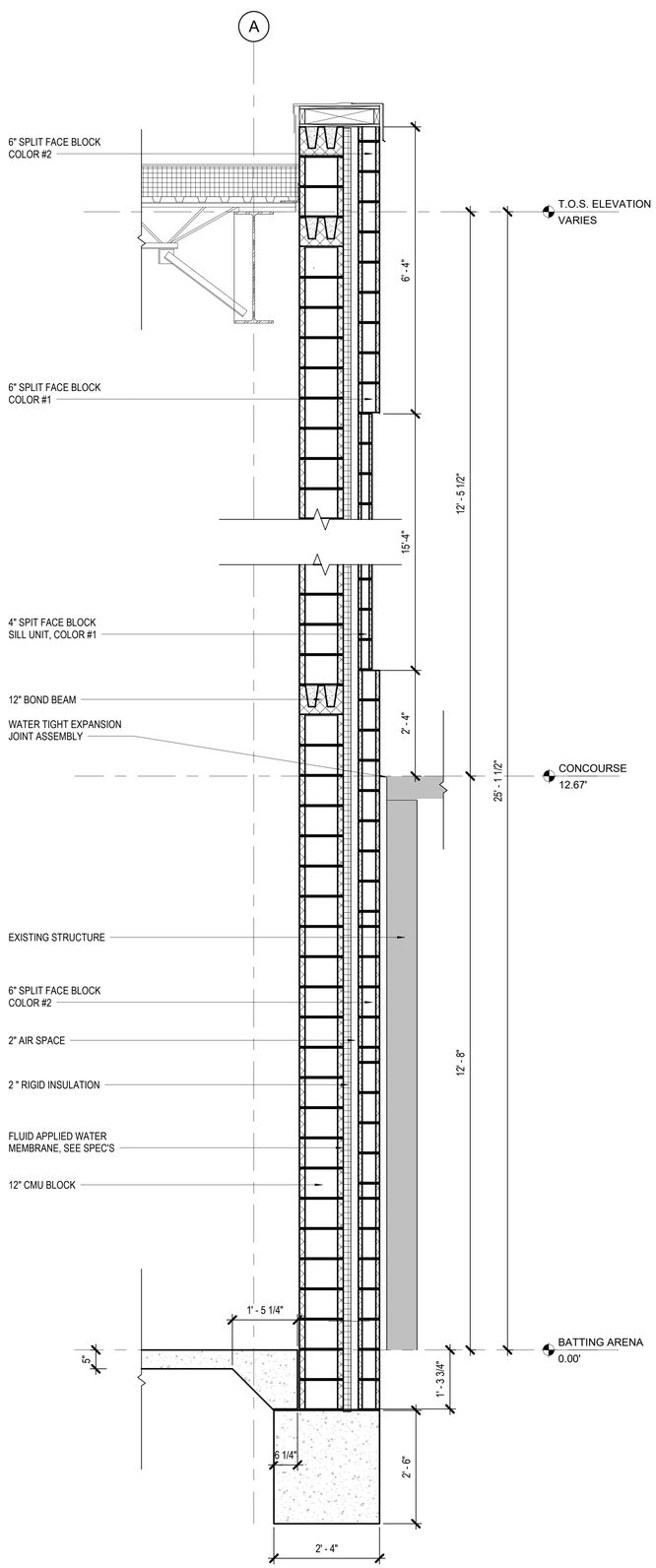
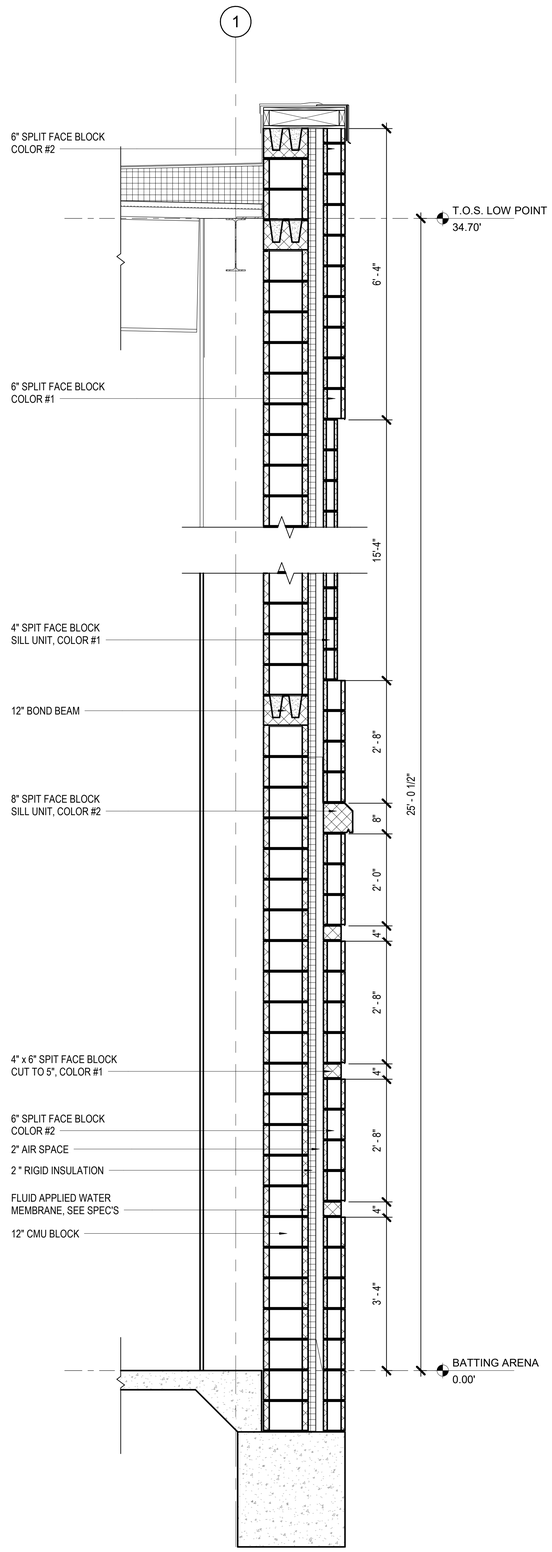


3 TYPICAL NORTH WALL SECTION
SCALE: 3/4" = 1'-0"



2 TYPICAL WEST WALL SECTION
SCALE: 3/4" = 1'-0"



1 TYPICAL SOUTH WALL SECTION
SCALE: 3/4" = 1'-0"

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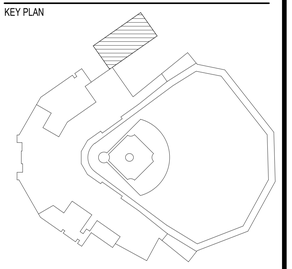

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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24
A	EC	ISSUE 1: SCHEMATIC DESIGN	3/18/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 3/4" = 1'-0"
DRAWING NAME

WALL SECTIONS

PHASE
CD

DRAWING NO.
A3.5.1

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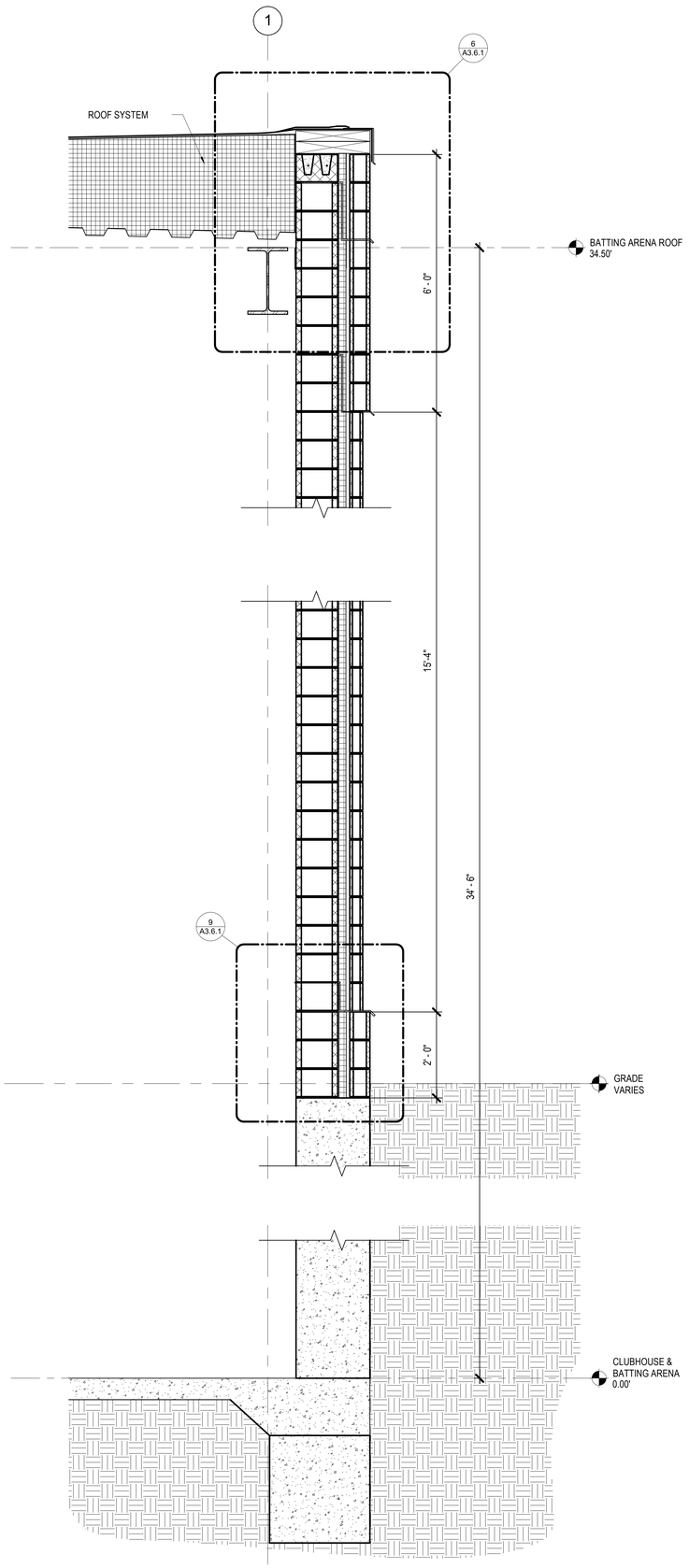
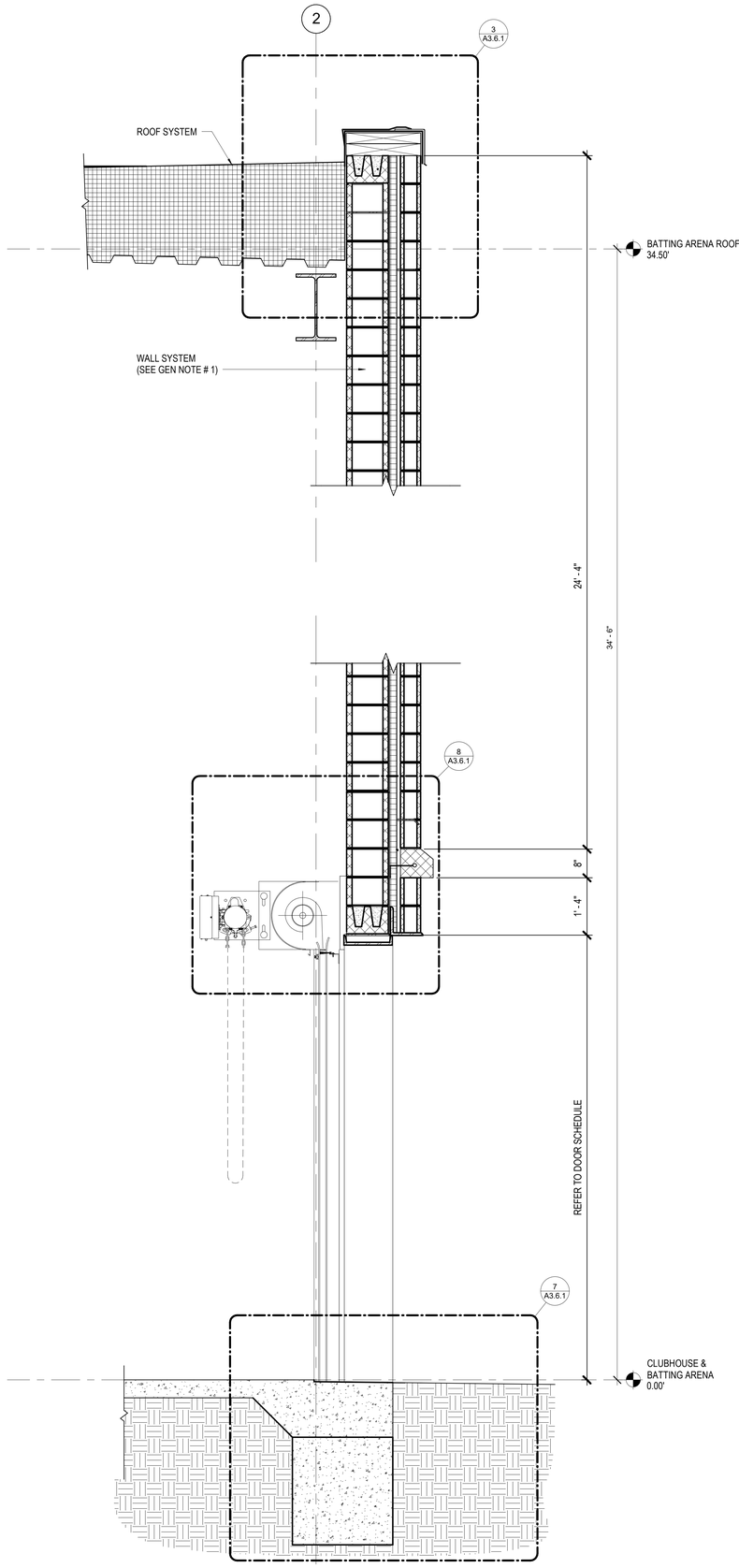


1 WALL SECTION AT RECESS IN CMU
SCALE: 3/4" = 1'-0"



2 WALL SECTION AT OVERHEAD DOOR
SCALE: 3/4" = 1'-0"

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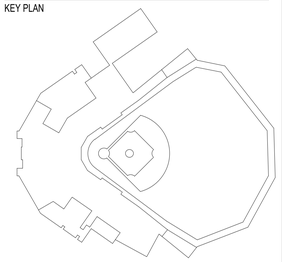

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DRAWN BY EC DATE
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DRAWING NAME
WALL SECTIONS

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DRAWING NO.
A3.5.2

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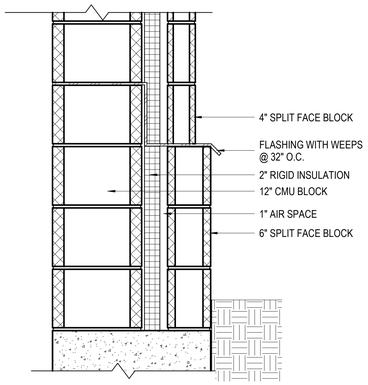
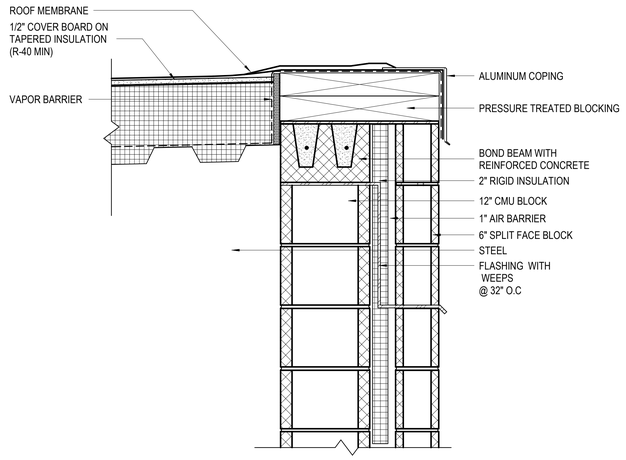
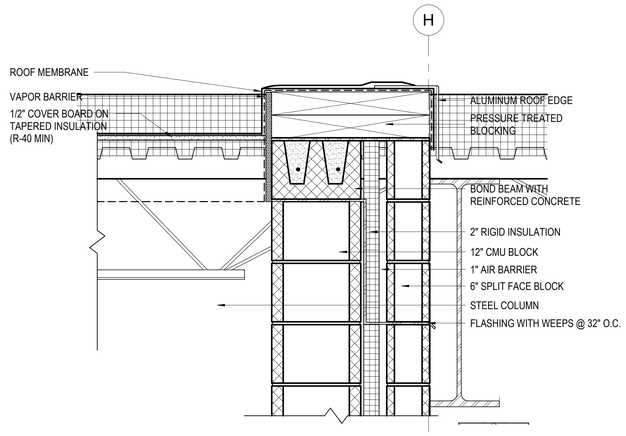


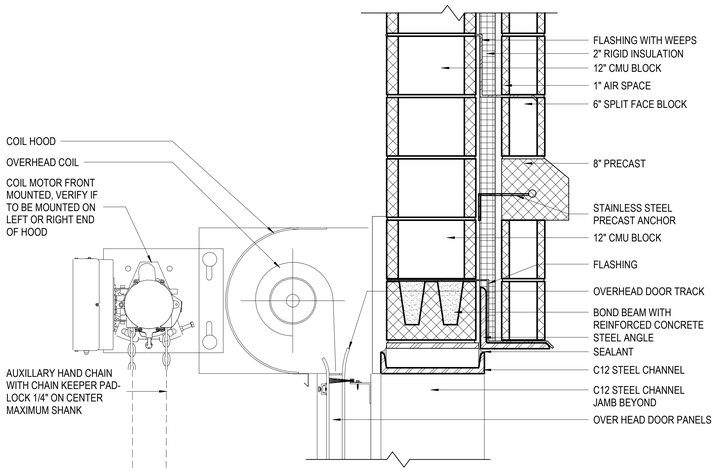
9 EXTERIOR BASE DETAIL
SCALE: 1 1/2" = 1'-0"



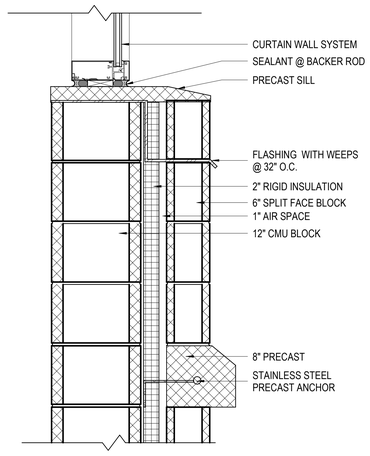
6 ROOF DETAIL AT ALUMINUM COPING
SCALE: 1 1/2" = 1'-0"



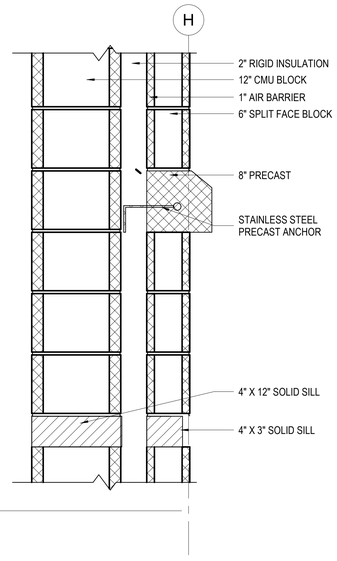
3 ROOF EDGE DETAIL
SCALE: 1 1/2" = 1'-0"



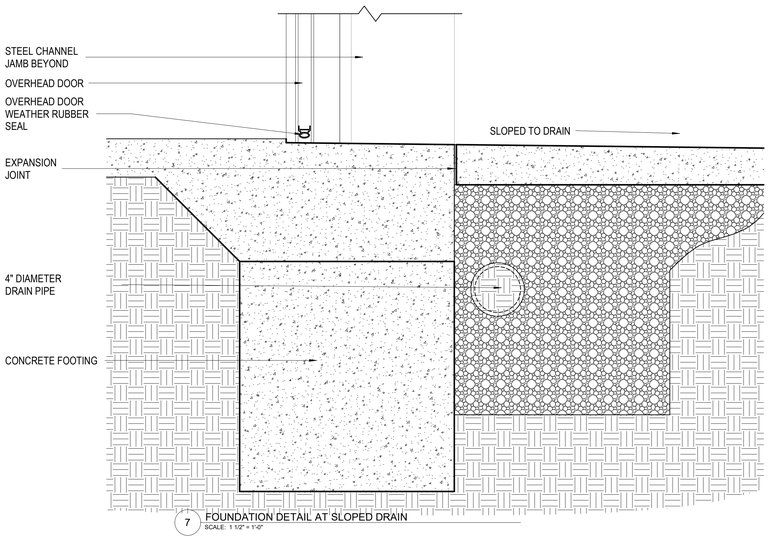
8 HEAD DETAIL AT OVERHEAD DOOR
SCALE: 1 1/2" = 1'-0"



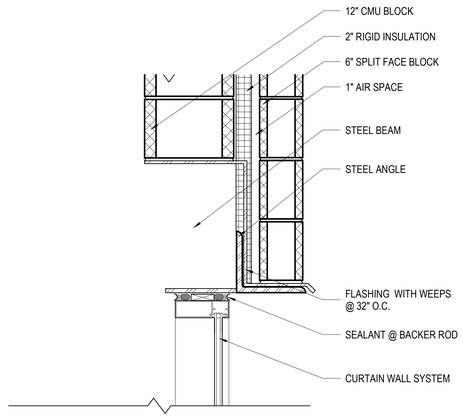
5 SILL DETAIL AT CURTAIN WALL
SCALE: 1 1/2" = 1'-0"



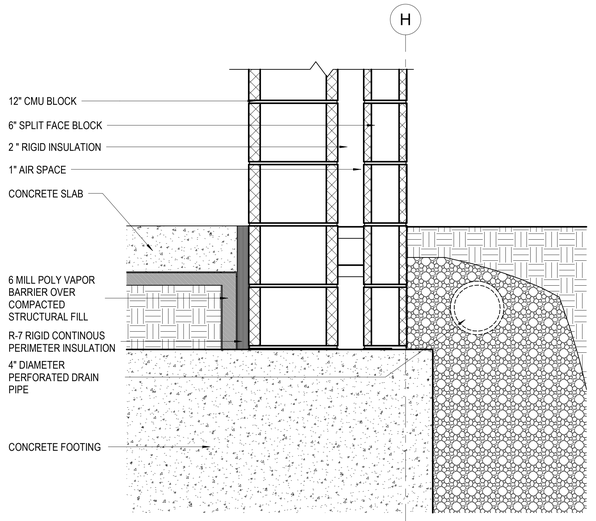
2 SILL DETAIL
SCALE: 1 1/2" = 1'-0"



7 FOUNDATION DETAIL AT SLOPED DRAIN
SCALE: 1 1/2" = 1'-0"



4 HEAD DETAIL AT CURTAIN WALL
SCALE: 1 1/2" = 1'-0"



1 FOUNDATION DETAIL
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
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STRUCTURAL ENGINEER
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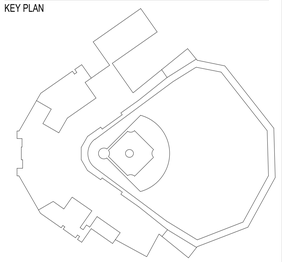
CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1 1/2" = 1'-0"
DRAWING NAME

WALL SECTION DETAILS

PHASE
CD

DRAWING NO.
A3.6.1

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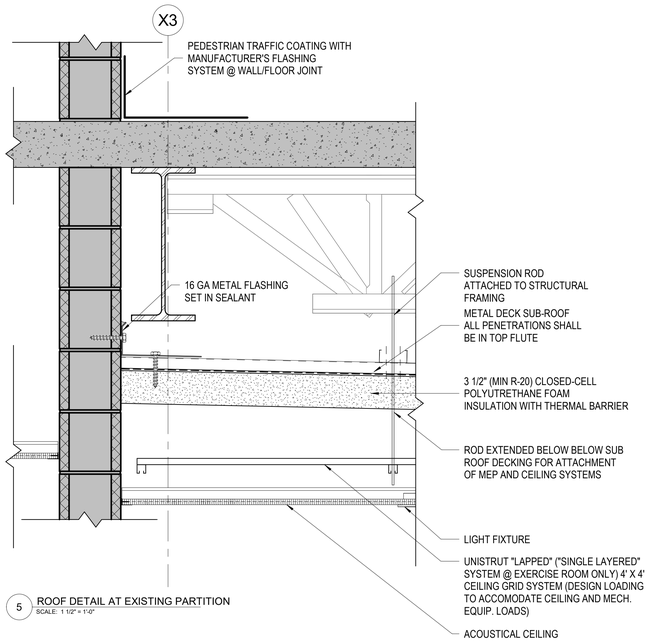
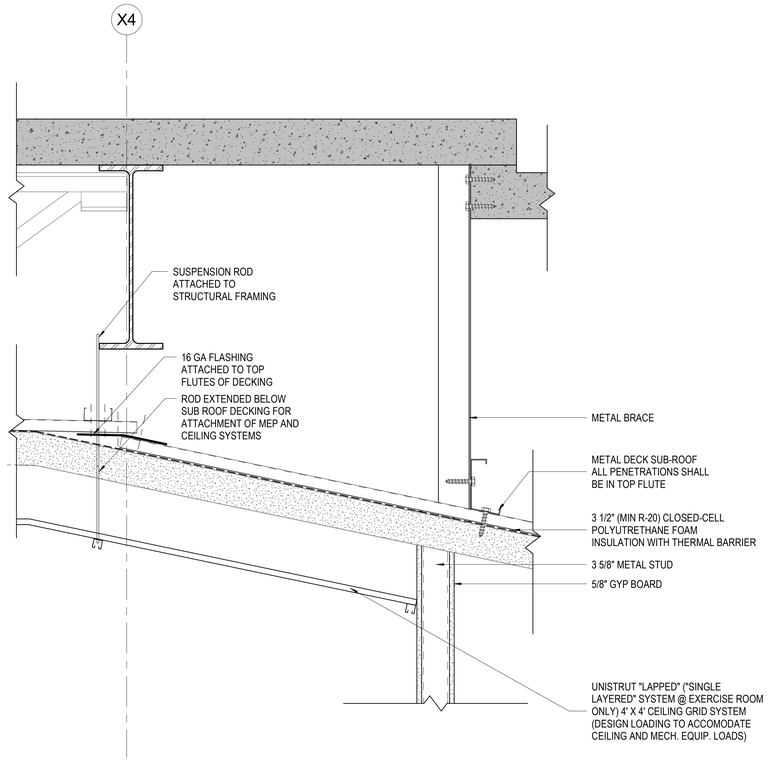
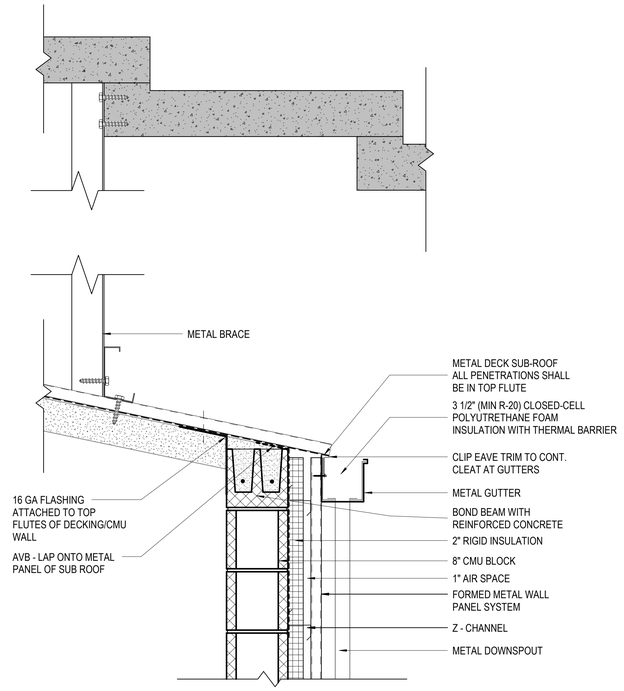


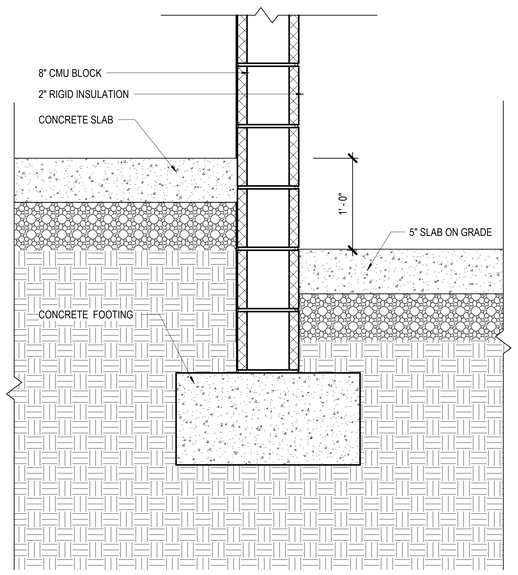
5 ROOF DETAIL AT EXISTING PARTITION
SCALE: 1 1/2" = 1'-0"



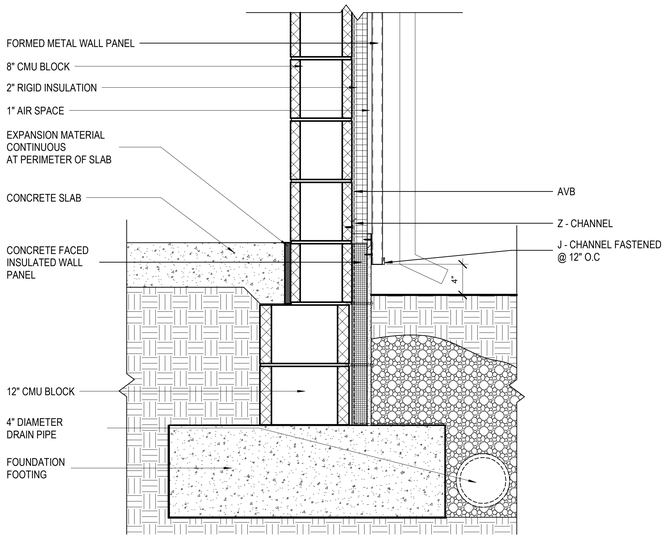
4 ROOF DETAIL AT BRACKET
SCALE: 1 1/2" = 1'-0"



2 ROOF DETAIL AT GUTTER
SCALE: 1 1/2" = 1'-0"



3 FOUNDATION DETAIL AT EXISTING CONCRETE SLAB
SCALE: 1 1/2" = 1'-0"



1 FOUNDATION DETAIL AT STONE PAD
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
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Gilbane
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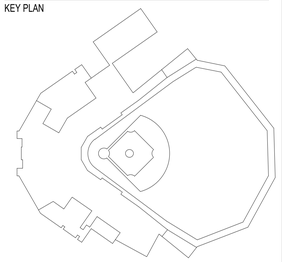
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1 1/2" = 1'-0"
DRAWING NAME

WALL SECTION DETAILS

PHASE
CD

DRAWING NO.
A3.6.2

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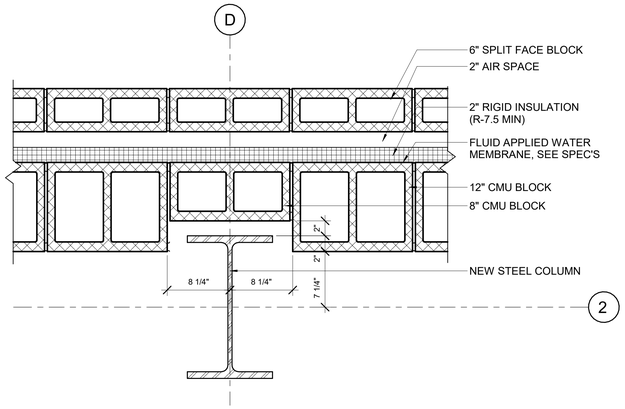
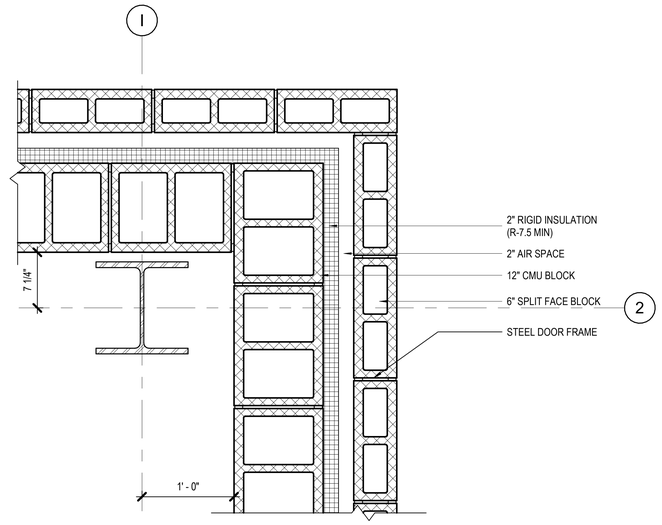
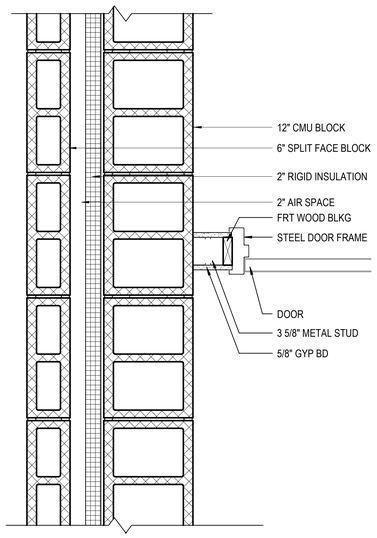


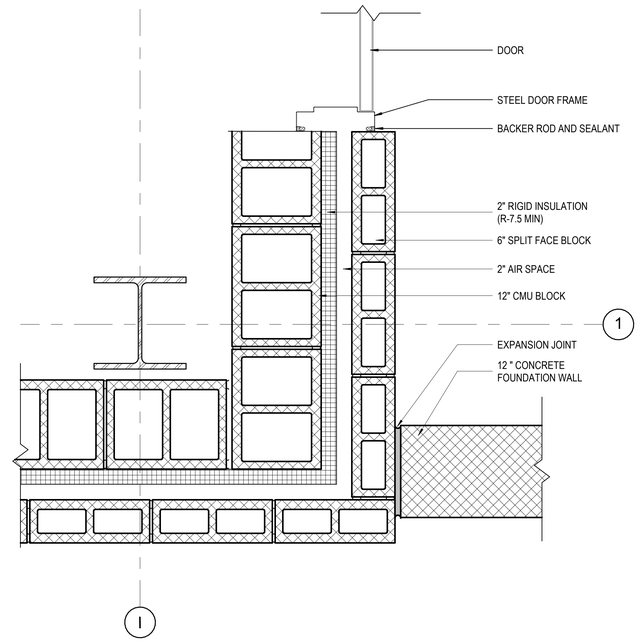
4 PLAN DETAIL AT CMU
SCALE: 1 1/2" = 1'-0"



2 CORNER PLAN DETAIL AT CMU
SCALE: 1 1/2" = 1'-0"



3 GYP TO CMU PLAN DETAIL
SCALE: 1 1/2" = 1'-0"



11 CORNER PLAN DETAIL AT FOUNDATION WALL
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
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Baltimore, MD 21201
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EWING COLE
810 Light Street
Baltimore, MD 21230-3970
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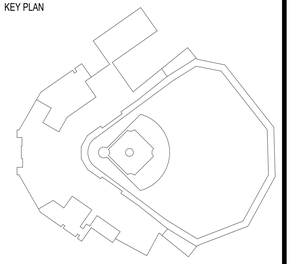

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1 1/2" = 1'-0"
DRAWING NAME
EXTERIOR PLAN DETAILS

PHASE CD
DRAWING NO. A3.7.1

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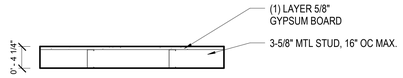
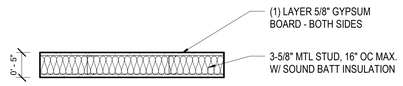
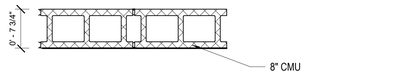
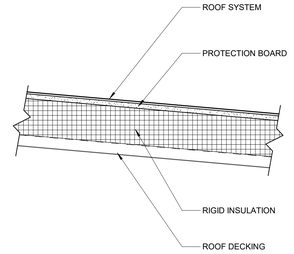
PARTITION SCHEDULE

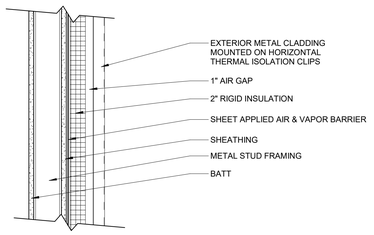
TAG #	ASSEMBLY	UL NUMBER & FIRE RATING	STC RATING	HEIGHT	COMMENTS
2AS			N/A	TO UNDERSIDE OF DECK/STRUCTURE ABOVE	INCLUDE BATT ISULATION WHEN ADJACENT TO SOUND RATED WALLS SUBSTITUTE GYPSUM BOARD W/ CEMENT BOARD AT ALL RESTROOMS & LOCKEROOMS PROVIDE DEFLECTION TRACK AT TOP OF WALL CONNECTION
2BS			49	TO UNDERSIDE OF DECK/STRUCTURE ABOVE	SUBSTITUTE GYPSUM BOARD W/ CEMENT BOARD AT ALL RESTROOMS & LOCKEROOMS PROVIDE DEFLECTION TRACK AT TOP OF WALL CONNECTION
6AS			47	TO UNDERSIDE OF DECK/STRUCTURE ABOVE	

NOTES

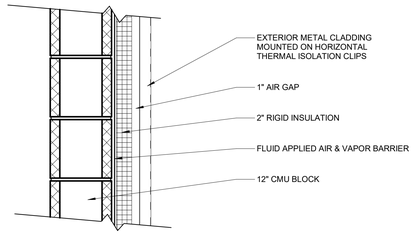
1. AT ANY PORTION OF INTERIOR WALL PARTITIONS THAT ARE TO BE FINISHED WITH THIN STONE/BRICK, PROVIDE 5/8" TILE BACKER BOARD IN PLACE OF 5/8" GYPSUM BOARD FOR ATTACHMENT OF THIN STONE/BRICK.
2. PROVIDE HEAVY DUTY METAL STUDS AT WALL PARTITIONS WITH THIN STONE/BRICK.



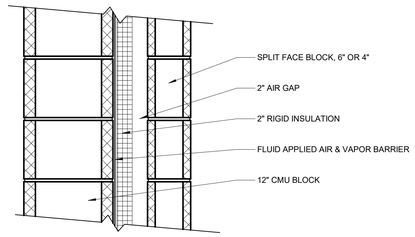
1 ROOF ASSEMBLY 1 - BATTING ARENA
SCALE: 1 1/2" = 1'-0"



4 WALL ASSEMBLY - CLUBHOUSE TYPICAL
SCALE: 1 1/2" = 1'-0"



3 WALL ASSEMBLY 2 - WEIGHT ROOM
SCALE: 1 1/2" = 1'-0"



2 WALL ASSEMBLY 1 - BATTING ARENA
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
351 West Camden Street
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CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME

PARTITION TYPES

PHASE
CD

DRAWING NO.
A4.1.1

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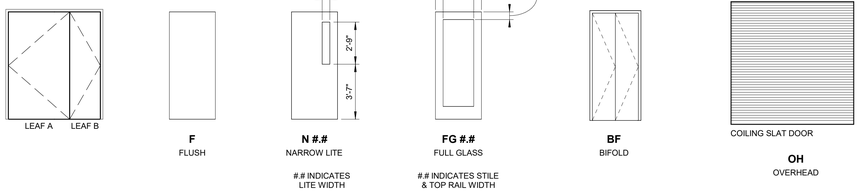
DOOR & FRAME SCHEDULE NOTES

1. HOLLOW METAL DOORS & FRAMES LISTED IN THE SCHEDULE SHALL BE PAINTED, UNLESS NOTED OTHERWISE. WOOD DOORS SHALL RECEIVE FACTORY TRANSPARENT FINISH.
2. WOOD DOORS SHALL BE SMARTWOOD CERTIFIED PRODUCTS.
3. PROVIDE 1/4" CLEAR TEMPERED GLASS AT VISION PANELS AT NON-RATED DOORS, UNLESS OTHERWISE NOTED. INCLUDE SAFETY GRAPHIC IN LOWER CORNER OF ALL TEMPERED GLASS LIGHTS
4. PROVIDE CLEAR, FIRE-RATED GLAZING AT VISION PANELS AT FIRE-RATED DOORS, UNLESS OTHERWISE NOTED. (GLASS NOT TO EXCEED ALLOWABLE AREA).
5. PROVIDE RATED ASSEMBLIES AT ALL RATED OPENINGS.
6. PROVIDE CONTINUOUS SEALANT AT ALL EDGES OF METAL FRAMES IN CONTACT WITH ADJACENT WALL SURFACES.



DOOR TYPES — ALL GLAZING TEMPERED UNO

DOOR MATERIAL — WD (WOOD); HM (HOLLOW METAL); AL(ALUMINUM); MET (METAL)

ATTRIBUTE — PTCH (PATCH FITTINGS); T&B (TOP & BOTTOM RAILS); FLDG (FOLDING)

FACE — PTD (PAINTED); PF (PRE-FINISHED); PLAM (PLASTIC LAMINATE)

NUMBER	DOOR SIZE OPENING	LEAF A	LEAF B	HEIGHT	DOOR TYPE	MATL	FACE	GLAZ	ATTR	SPEC SECTION	FRAME TYPE	MATL	GLAZ	FIRE RATING	REMARKS
CLUBHOUSE & BATTING ARENA															
109	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
111A	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
111B	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
113A	2' - 0"	2' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
115	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
122	2' - 0"	2' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
123	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
126	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
127	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
129	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
149	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
151	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
158	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
159	3' - 6"	3' - 6"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
160	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
161	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
163	2' - 0"	2' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
166A	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
167	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
169	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
169A	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
169B	2' - 0"	2' - 0"		7' - 0"	BF	WD	PLAM		FLDG	081416	A	HM	--	0	
172	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
172A	3' - 0"	3' - 0"		7' - 0"	F	WD	PLAM			081113	A	HM	--	0	
181	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
182A	6' - 0"	3' - 0"	3' - 0"	7' - 0"	F	HM	PTD			081113	A	HM	--	0	
182B	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
183	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
184	6' - 0"	3' - 0"	3' - 0"	7' - 0"	F	HM	PTD			081113	A	HM	--	0	
185A	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
188	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
189	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
190	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
191	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
195A	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
195B	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
196	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
197	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
198	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
199	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
200	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
201	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
204	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
509	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
517	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
527	6' - 0"	3' - 0"	3' - 0"	7' - 4"	F	HM	PTD			081113	A	HM	--	0	
533	3' - 0"	3' - 0"		7' - 4"	F	HM	PTD			081113	A	HM	--	0	
669	6' - 0"	3' - 0"	3' - 0"	7' - 0"	N 6.0	HM	PTD			081113	B	HM	--	0	
677	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
685					OH	MET	PF			083323	RMP	MET	--	0	
693	3' - 0"	3' - 0"		7' - 4"	F	HM	PTD			081113	A	HM	--	0	
715					OH	MET	PF			083323	RMP	MET	--	0	
716	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
724	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
740	3' - 0"	3' - 0"		7' - 0"	F	HM	PTD			081113	A	HM	--	0	
1906	6' - 0"	3' - 0"	3' - 0"	7' - 0"	F	HM	PTD			081113	B	HM	--	0	
DUGOUT															
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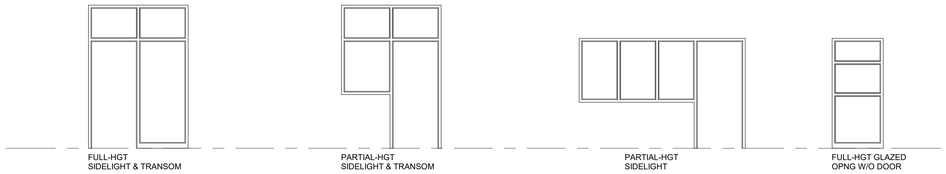
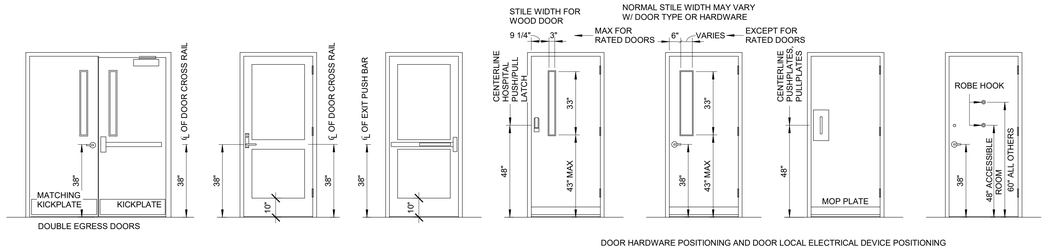


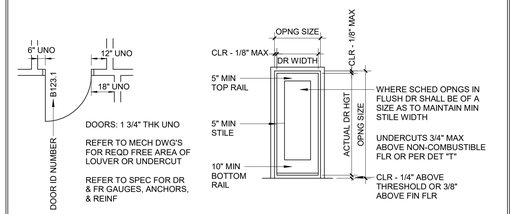
2 FRAME TYPES
SCALE: 1/4" = 1'-0"



DOOR HARDWARE POSITIONING AND DOOR LOCAL ELECTRICAL DEVICE POSITIONING

1 DOOR HARDWARE POSITIONING
SCALE: 3/8" = 1'-0"

GENERAL DOOR DEFINITIONS



NOTE: DOOR TYPE NUMBERS, FRAME TYPES, AND HARDWARE NUMBERS MAY NOT BE CONSECUTIVE

GLAZING REQUIREMENTS:
1. ALL DOOR & SIDELITE GLAZING SHALL BE 1/4" UNO
2. ALL DOOR GLAZING SHALL BE SAFETY LABELED TEMPERED GLASS (TG) UNO
3. ALL INTERIOR PARTITION OR SIDELITE GLAZING SHALL BE TEMPERED GLASS (TG) UNO
4. GLAZING IN FIRE RATED DOORS SHALL BE 5/16" FIRE RATED GLAZING

DOOR SCHEDULE LEGEND:

GLAZING

FG	FLOAT GLASS	
FP	FIRE PROTECTION GLAZING	
FR	FIRE RESISTIVE GLAZING	
LG	LAMINATED GLASS	SEE SPECS FOR TYPES
SG	SPECIAL GLAZING	SEE SPECS FOR TYPES
TG	TEMPERED GLASS	
WG	WIRE GLASS	
PC	POLYCARBONATE GLAZING	SEE SPECS FOR TYPES

ELECTRICAL

P	POWER (120VAC and UP)
S	SECURITY RELATED (12 TO 24V)
F	FIRE ALARM RELATED (12 TO 24V)
X	RADIOLOGY RELATED

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Gilbane
The Liberty Building at McHenry Row
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Baltimore, MD 21230
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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

DOOR SCHEDULES & DETAILS

PHASE CD

DRAWING NO. A4.2.1

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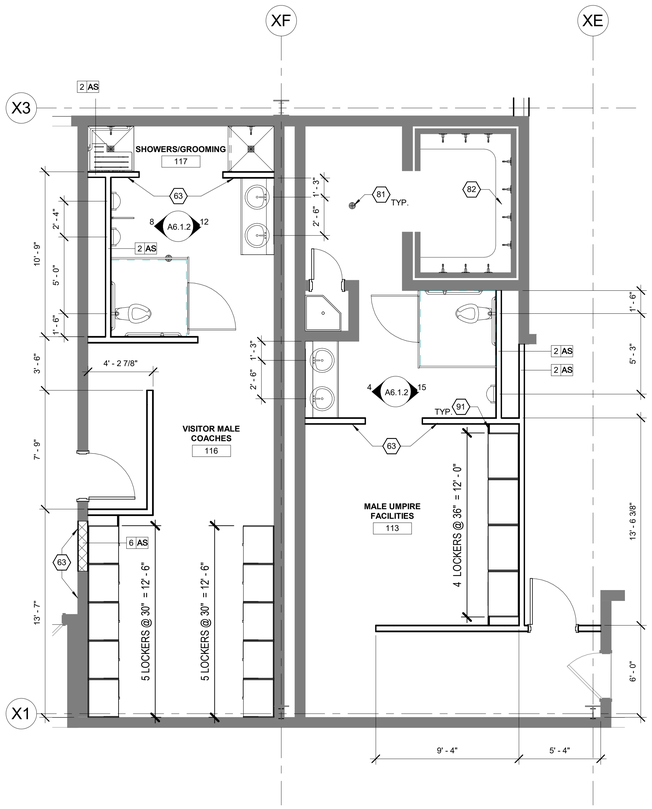
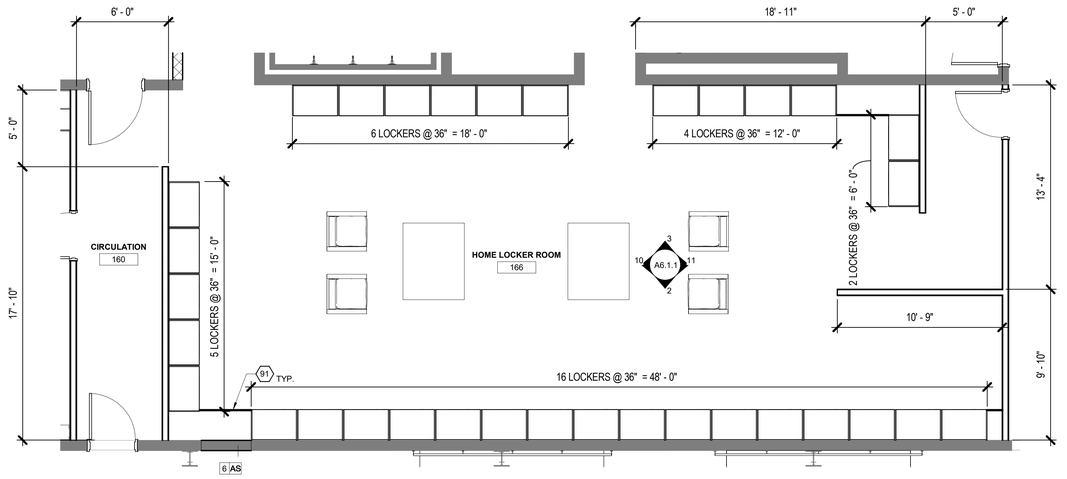
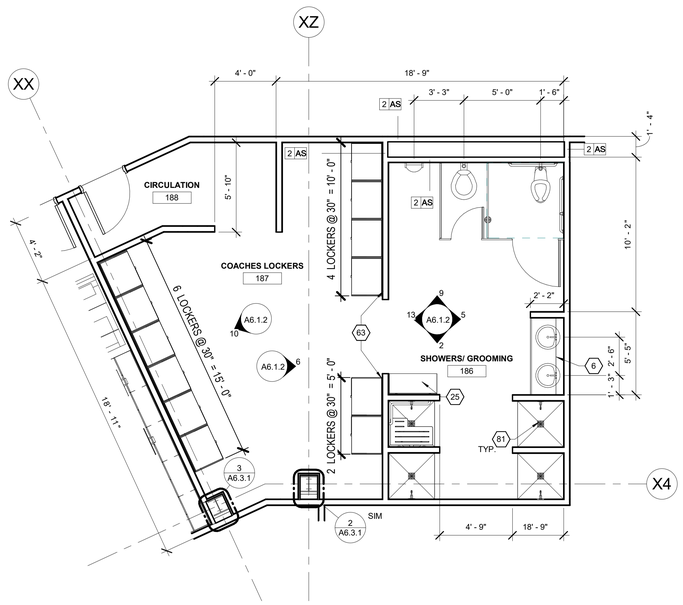


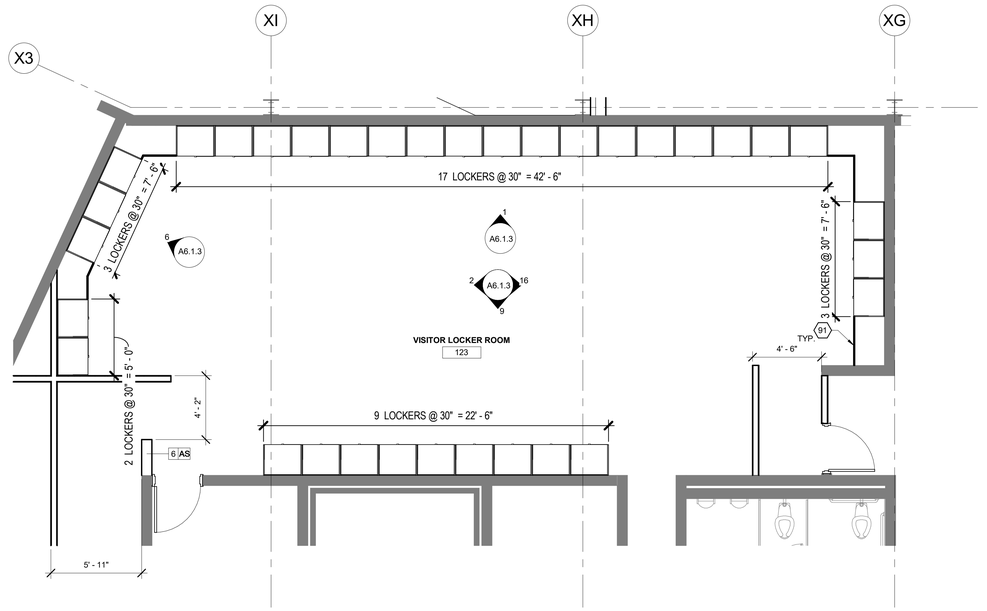
4 VISITOR MALE COACHES 116 & MALE UMPIRE FACILITIES 113 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"



2 HOME LOCKER ROOM 166 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"



3 COACHES LOCKERS 187 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"



1 VISITOR LOCKER ROOM 123 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
- UNFINISHED SPACE

GENERAL NOTES

1. ALL INTERIOR PARTITIONS SHOULD BE WALL TYPE 2BS UNLESS OTHERWISE NOTED.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND POSTING ALL REQUIRED LOCAL AND STATE CONSTRUCTION PERMITS.
3. VERIFY ALL EXISTING FIELD CONDITIONS ARE CONSISTENT WITH THE DOCUMENTS BEFORE PROCEEDING. REPORT INCONSISTENCIES TO THE ARCHITECT.
4. ACCESS TO AREAS OUTSIDE THE PROJECT AREA LINE SHALL BE COORDINATED IN ADVANCE WITH THE OWNER.
5. ALL UTILITY SHUT DOWNS OR SUSPENSION OF MECHANICAL OR ELECTRICAL SERVICES SHALL BE SCHEDULED IN ADVANCE WITH THE OWNER.
6. UNLESS OTHERWISE NOTED ON DOCUMENTS, ALL PAINTING SHALL BE FROM A CORNER TO A CORNER AND CEILING TO FLOOR REGARDLESS OF AREA ACTUALLY DISTURBED.
7. MECHANICAL AND ELECTRICAL DEVICES, FIXTURES, PANELS AND EQUIPMENT INSTALLED IN FINISHED SPACES SHALL BE INSTALLED SO ONLY THE DEVICE, FIXTURE OR EQUIPMENT IS EXPOSED. NO PIPE, DUCT, CONDUIT, WIRE OR OTHER SUCH ELEMENT SHALL BE EXPOSED.
8. PRIOR TO SCHEDULED FINISHING OF EXISTING WALLS, REPAIR MINOR DENTS, IMPERFECTIONS AND SCRAPES.
9. NEW CEILINGS SHALL BE SUSPENDED FROM STRUCTURAL ELEMENTS AND BE INSTALLED PER DIVISION 09 SECTION "DRYWALL SYSTEMS."
10. NEW WALLS SHALL BE ERECTED AS INDICATED AND PER DIVISION 09 SECTION "DRYWALL SYSTEMS."
11. NEW UL RATED WALLS SHALL BE ERECTED BY HOURLY RATING PRIORITY IN DESCENDING ORDER AND SHALL BE ERECTED PRIOR TO NON-RATED WALLS. UL RATED WALLS INTERSECTING EXTERIOR WALLS SHALL BE EXTENDED THROUGH TO THE EXTERIOR SHEATHING. REMOVE EXTERIOR WALL AS REQUIRED TO PROPERLY INSTALL AND REPAIR IN KIND.
12. ROOF SHOULD SLOPE 1/4" TOWARD DRAINS WHERE INDICATED ON ROOF PLAN TYPICALLY.

KEYNOTES

6	4" INTEGRAL SHELF FOR TOILETRIES
25	TOWEL SHELF
63	ALIGN FINISH SURFACE
81	SLOPE TO FLOOR DRAIN
82	SLOPE TO TRENCH DRAIN
91	FILLER PANEL

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

ENLARGED PLANS

PHASE CD

DRAWING NO. A5.1.1

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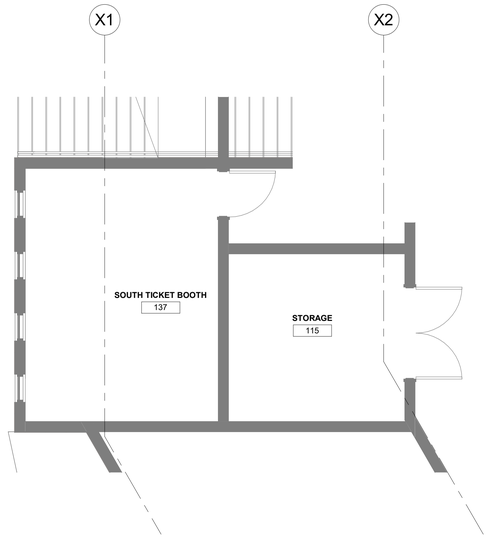
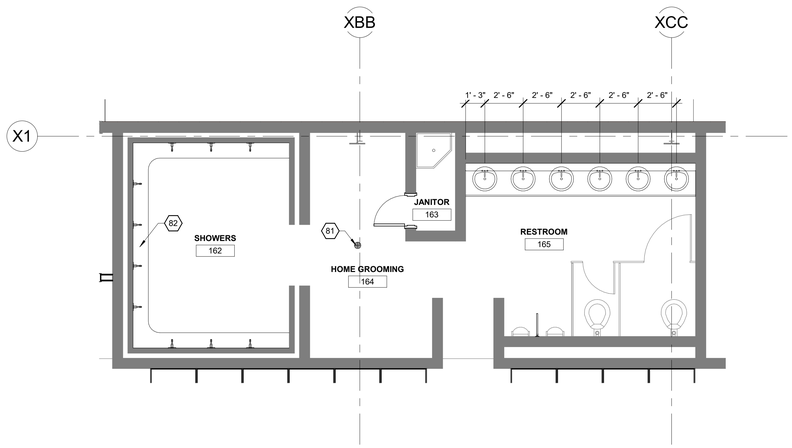
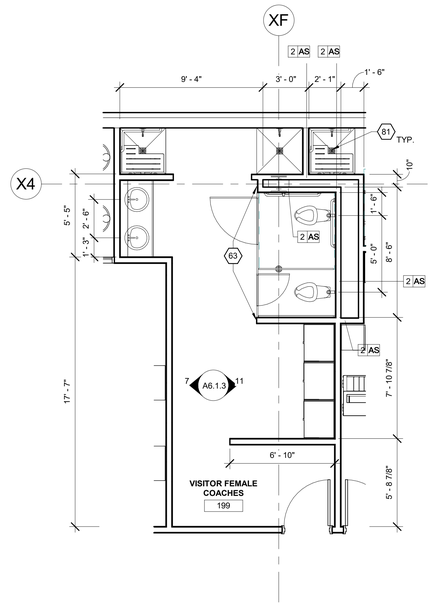


2 SOUTH TICKET BOOTH 137/ STORAGE 115 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"



3 HOME GROOMING 164
SCALE: 1/4" = 1'-0"



1 VISITOR FEMALE COACHES 199 - ENLARGED PLAN
SCALE: 1/4" = 1'-0"

LEGEND

- NEW WALL
- EXISTING WALL TO REMAIN
- NEW DOOR
- EXISTING DOOR TO REMAIN
- N.I.C. (NOT IN CONTRACT)
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KEYNOTES

- 63 ALIGN FINISH SURFACE
- 81 SLOPE TO FLOOR DRAIN
- 82 SLOPE TO TRENCH DRAIN

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A5.1.2

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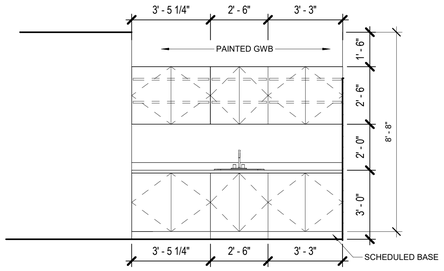
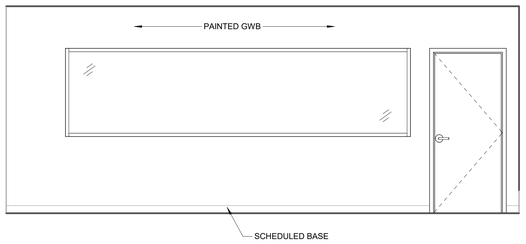
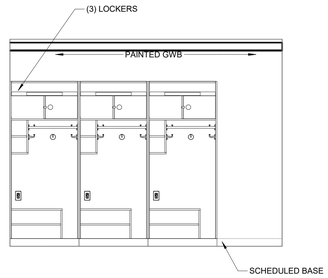


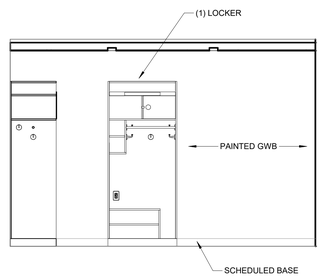
16 SHARED WEIGHT ROOM 182 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



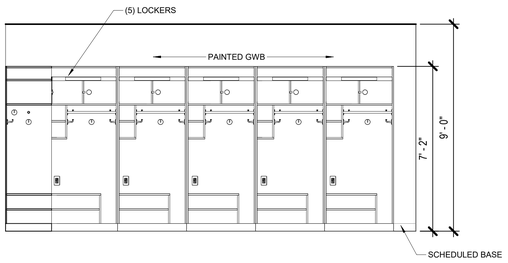
12 SHARED WEIGHT ROOM 182 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



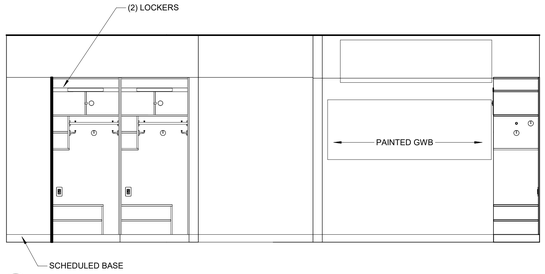
8 FEMALE LOCKER ROOM 172 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



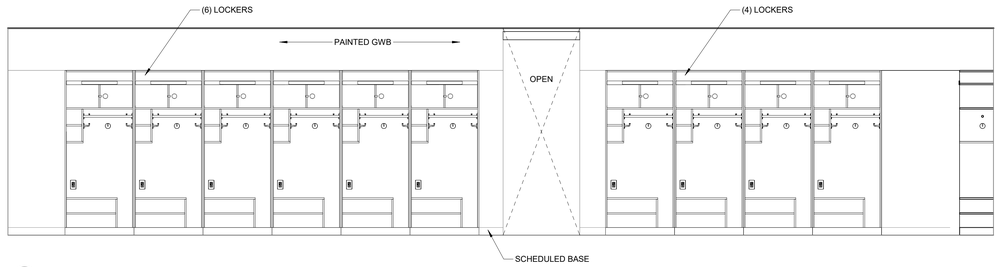
4 FEMALE LOCKER ROOM 172 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



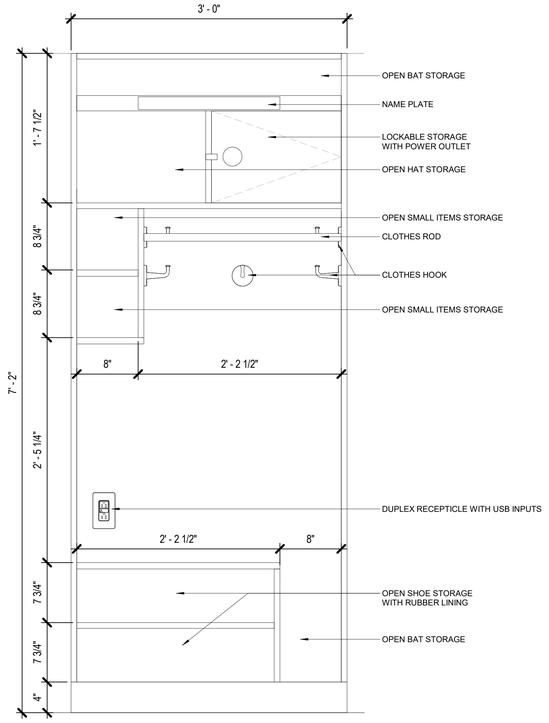
10 HOME LOCKER ROOM 166 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



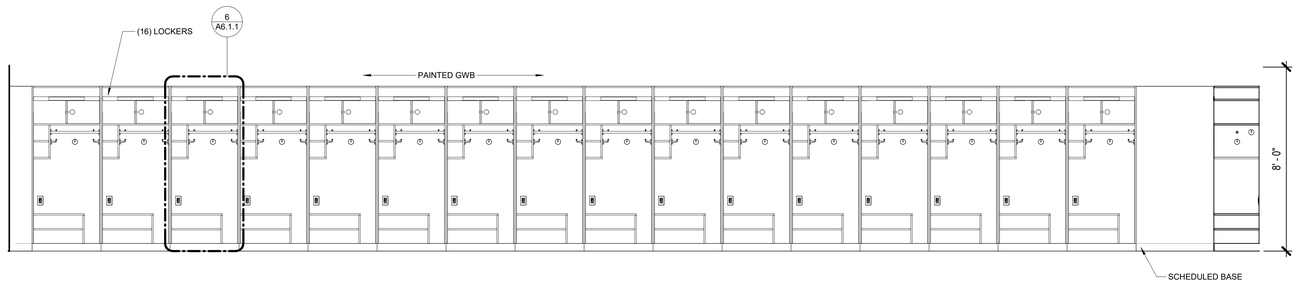
11 HOME LOCKER ROOM 166 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



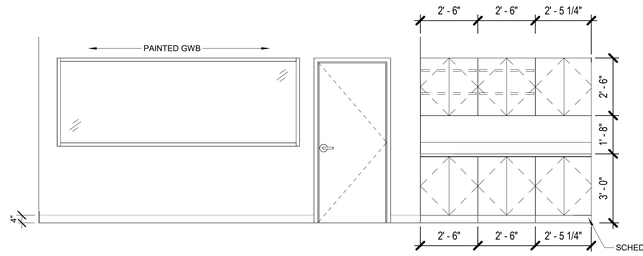
3 HOME LOCKER ROOM 166 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"



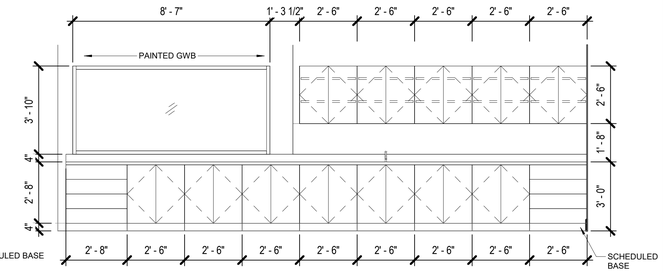
6 HOME LOCKER TYP
SCALE: 1 1/2" = 1'-0"



2 HOME LOCKER ROOM 166 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



5 TRAINER'S OFFICE 161 - SOUTH/WEST ELEVATION
SCALE: 3/8" = 1'-0"



1 HOME TRAINING ROOM 158 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

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PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME

INTERIOR ELEVATIONS

PHASE CD
DRAWING NO. A6.1.1

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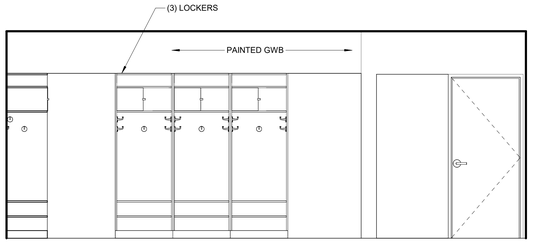
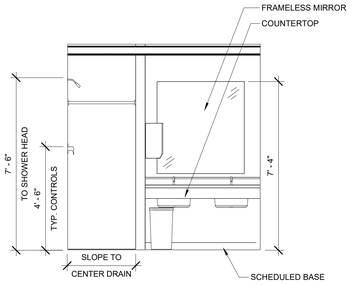
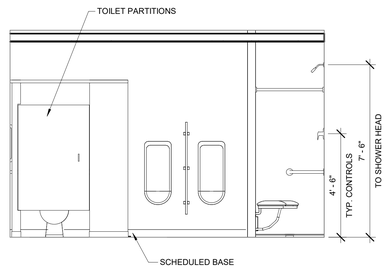


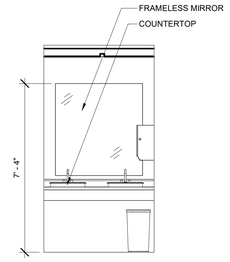
16 VISITOR LOCKER ROOM 123 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



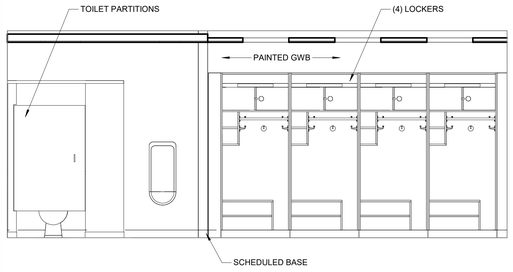
12 VISITOR MALE COACHES 116 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



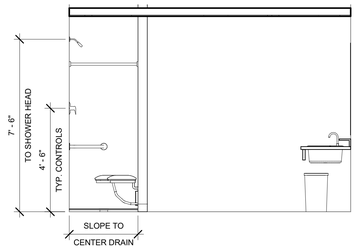
8 VISITOR MALE COACHES 116 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



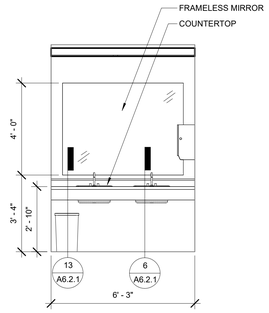
4 MALE UMPIRE FACILITIES 113 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



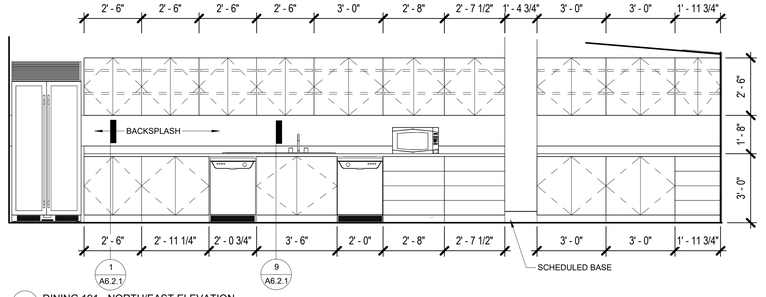
15 MALE UMPIRE FACILITIES 113 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



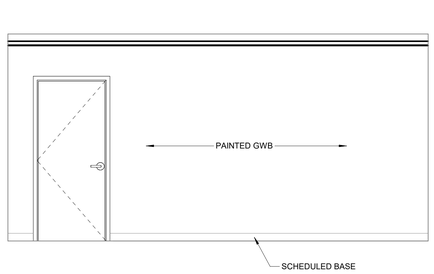
11 FEMALE UMPIRE FACILITIES 108 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



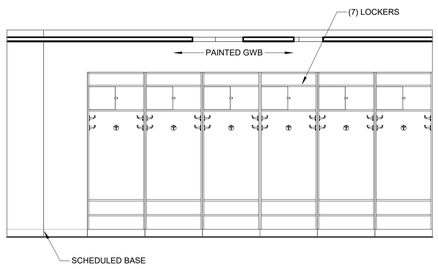
7 FEMALE UMPIRE FACILITIES 108 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



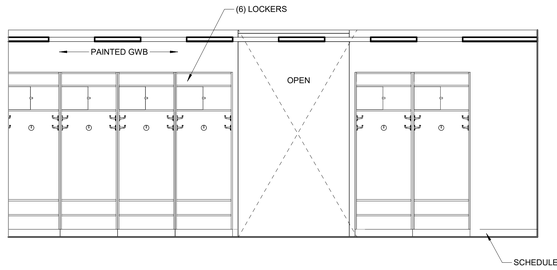
3 DINING 191 - NORTH/EAST ELEVATION
SCALE: 3/8" = 1'-0"



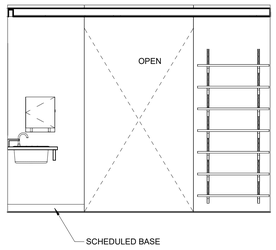
14 OPEN OFFICE 189 - SOUTH/EAST ELEVATION
SCALE: 3/8" = 1'-0"



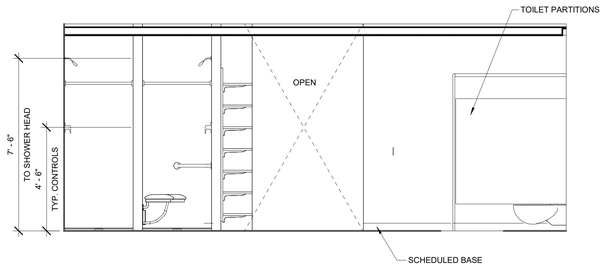
10 COACHES LOCKERS 187 - SOUTH/WEST ELEVATION
SCALE: 3/8" = 1'-0"



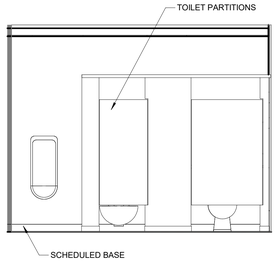
6 COACHES LOCKERS 187 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



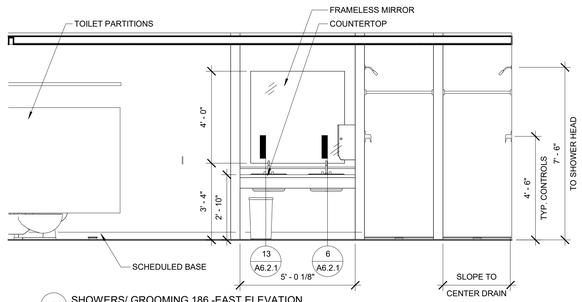
2 SHOWERS/ GROOMING 186 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



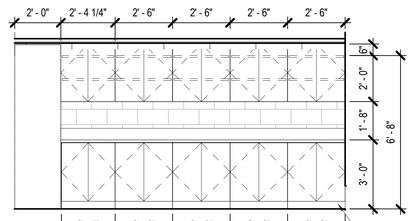
13 SHOWERS/ GROOMING 186 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



9 SHOWERS/ GROOMING 186 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"



5 SHOWERS/ GROOMING 186 -EAST ELEVATION
SCALE: 3/8" = 1'-0"



1 WEIGHT OFFICE 183 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
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STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

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CONVERGENT TECHNOLOGIES DESIGN GROUP

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Project Architect
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Project Model Lead
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 3/8" = 1'-0"
DRAWING NAME
INTERIOR ELEVATIONS

PHASE CD
DRAWING NO. A6.1.2

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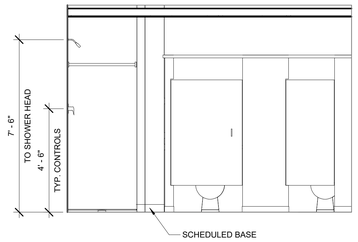
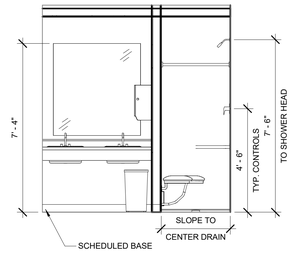
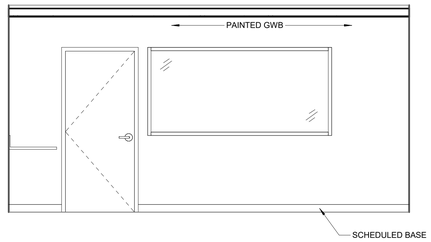


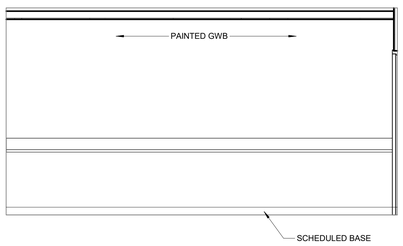
11 VISITOR FEMALE COACHES 199 - EAST ELEVATION
SCALE: 3/8" = 1'-0"



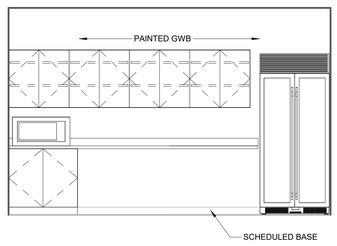
7 VISITOR FEMALE COACHES 199 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



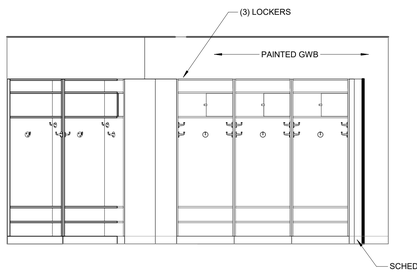
3 VISITOR TRAINING ROOM 198 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"



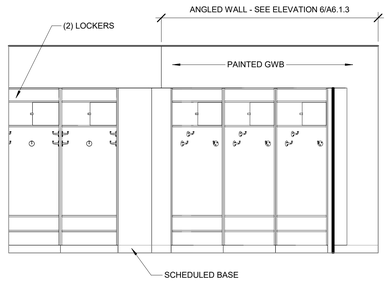
14 VISITOR TRAINING ROOM 198 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



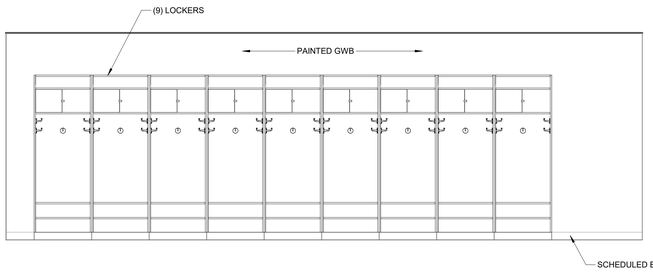
10 VISITOR DINING ROOM 196 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"



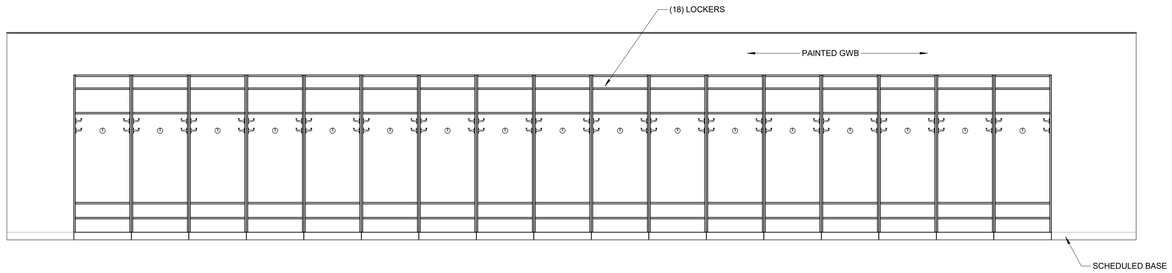
6 VISITOR LOCKER ROOM 123 - NORTH/WEST ELEVATION
SCALE: 3/8" = 1'-0"



2 VISITOR LOCKER ROOM 123 - WEST ELEVATION
SCALE: 3/8" = 1'-0"



9 VISITOR LOCKER ROOM 123 - SOUTH ELEVATION
SCALE: 3/8" = 1'-0"



1 VISITOR LOCKER ROOM 123 - NORTH ELEVATION
SCALE: 3/8" = 1'-0"

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane

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Tel: 410-649 1750

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EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

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CONVERGENT TECHNOLOGIES DESIGN GROUP

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Project Model Lead
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 3/8" = 1'-0"
DRAWING NAME

INTERIOR ELEVATIONS

PHASE
CD

DRAWING NO.
A6.1.3

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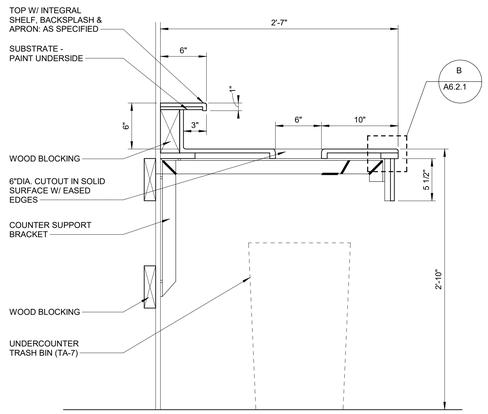
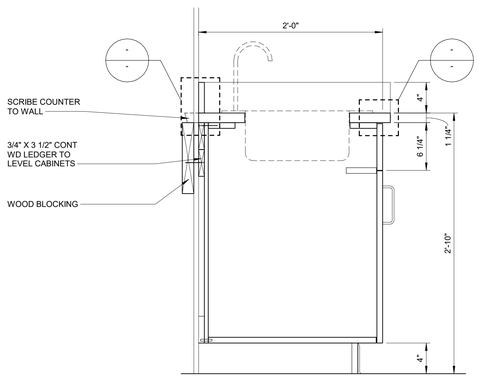
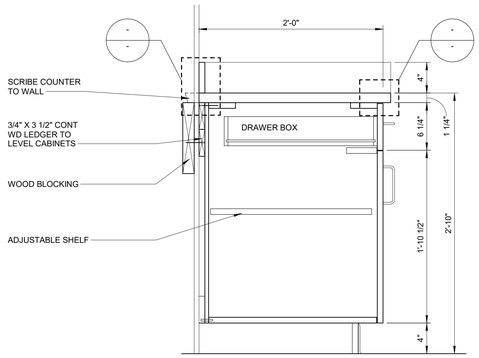


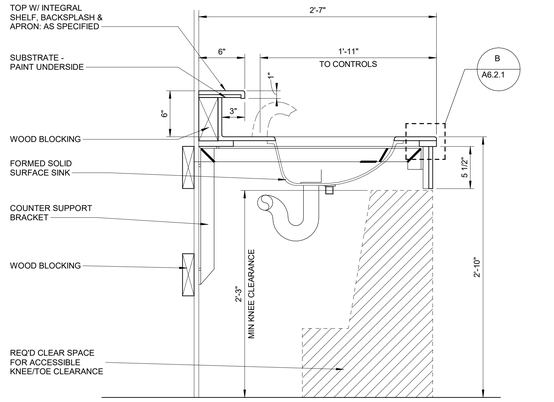
13 ACCESSIBLE COUNTER W/ INTEGRAL SHELF & TRASH CUTOUT
SCALE: 1 1/2" = 1'-0"



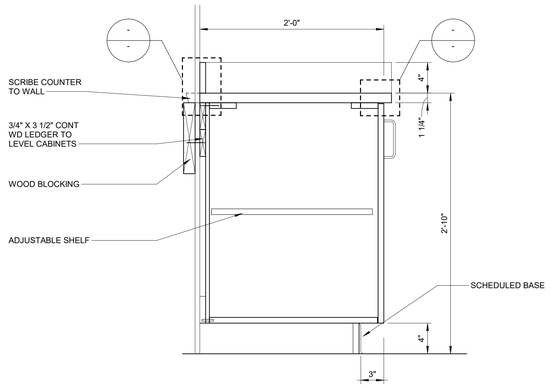
9 BASE CABINET W/ SINK
SCALE: 1 1/2" = 1'-0"



5 BASE CABINET WITH DRAWER
SCALE: 1 1/2" = 1'-0"



6 ACCESSIBLE LAVATORY COUNTER W/ INTEGRAL SHELF
SCALE: 1 1/2" = 1'-0"



1 BASE CABINET
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
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Baltimore, MD 21230-3970
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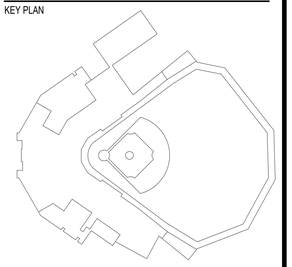
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
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SN
Project Model Lead
SN

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1 1/2" = 1'-0"
DRAWING NAME
INTERIOR ARCHITECTURAL MILLWORK

PHASE
CD
DRAWING NO.
A6.2.1

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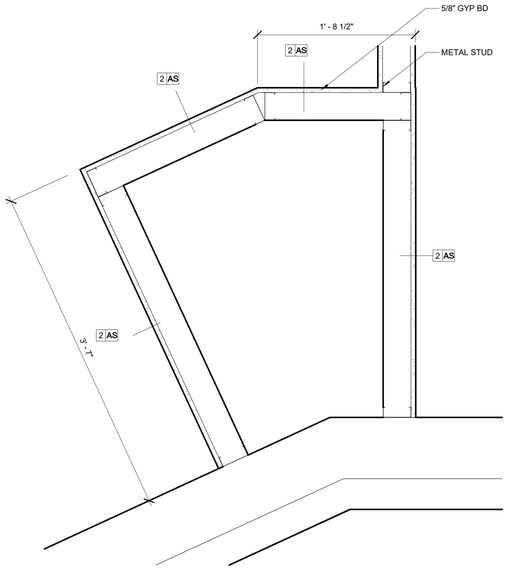
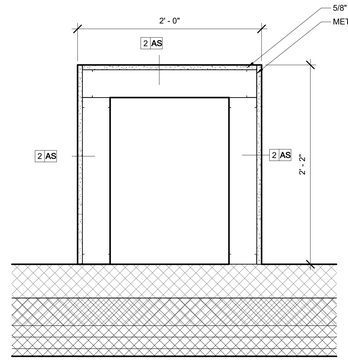
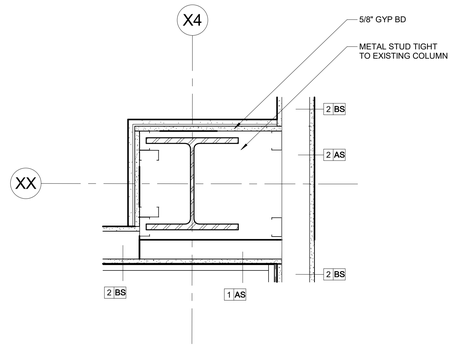


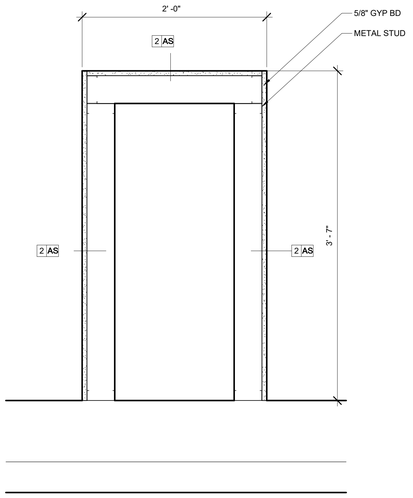
6 Z PLAN DETAIL
SCALE: 1 1/2" = 1'-0"



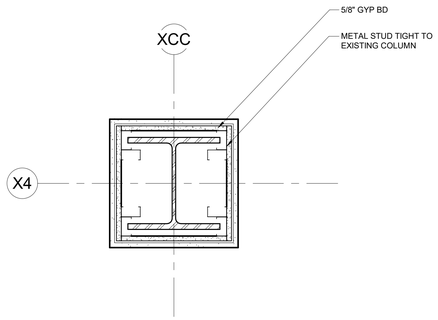
4 CC PLAN DETAIL
SCALE: 1 1/2" = 1'-0"



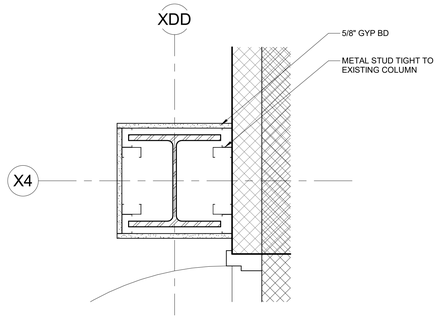
3 X4 PLN DETAIL
SCALE: 1 1/2" = 1'-0"



5 AA PLAN DETAIL
SCALE: 1 1/2" = 1'-0"



2 CC4 PLAN DETAIL
SCALE: 1 1/2" = 1'-0"



1 DD4 PLAN DETAIL
SCALE: 1 1/2" = 1'-0"

MARYLAND STADIUM AUTHORITY
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STRUCTURAL ENGINEER
EWINGCOLE

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McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1 1/2" = 1'-0"
DRAWING NAME

INTERIOR DETAILS

PHASE
CD

DRAWING NO.
A6.3.1

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2 CLUBHOUSE & BATTING ARENA
SCALE: 1/8" = 1'-0"

CEILING TYPE LEGEND

- GWB or PLASTER CEILING or SOFFIT
- 2'-0" x 4'-0" RECESSED
- EXT WALL MTD LIGHT
- RECESSED DOWNLIGHT
- RECESSED WALL WASHER
- CEILING MTD EXIT LIGHT, UNO
- DIFFUSER - SEE HVAC DWGS
- LINEAR DIFFUSER
- RETURN/EXHAUST GRILLE
- CEILING ACCESS PANEL

GENERAL NOTES

1. ALL CEILINGS ACOUSTICAL CEILING TILE AT 8'-6" UNO.
2. ALL OTHER CEILING LABELED AS FOLLOWS:

A1 8'-6"
CEILING TYPE — CEILING HEIGHT

A	ACOUSTICAL CEILING TILE
EX	EXISTING TO REMAIN
G	GWB, PAINTED
NC	NO CEILING

3. ALL CEILING GRIDS SHALL BE CENTERED ON ROOM/SPACE UNO.
4. ALL FIXTURES, DIFFUSERS, GRILLS, SPRINKLER HEADS, SPEAKERS OR OTHER DEVICES SHALL BE LOCATED IN THE CENTER OF A CEILING TILE OR THE CENTER OF A PANEL INSCRIBED ON A TILE, UNO.
5. CENTER ALL INDUSTRIAL PENDANT FIXTURES IN ROOM UNO.
6. COORDINATE PROJECTOR LOCATIONS WITH FINAL PROJECTOR MANUFACTURER.

KEYNOTES

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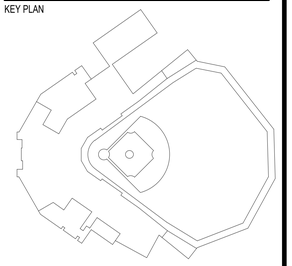

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

HOME CLUBHOUSE RCP

PHASE CD
DRAWING NO. A7.1.A

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1 VISITOR CLUBHOUSE RCP
SCALE: 1/8" = 1'-0"

CEILING TYPE LEGEND

- GWB or PLASTER CEILING or SOFFIT
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- RECESSED DOWNLIGHT
- RECESSED WALL WASHER
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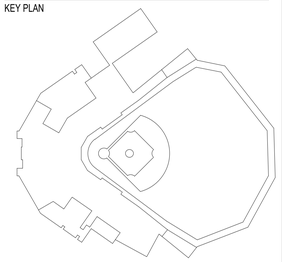

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME
VISITOR CLUBHOUSE RCP

PHASE CD
DRAWING NO. A7.1.B

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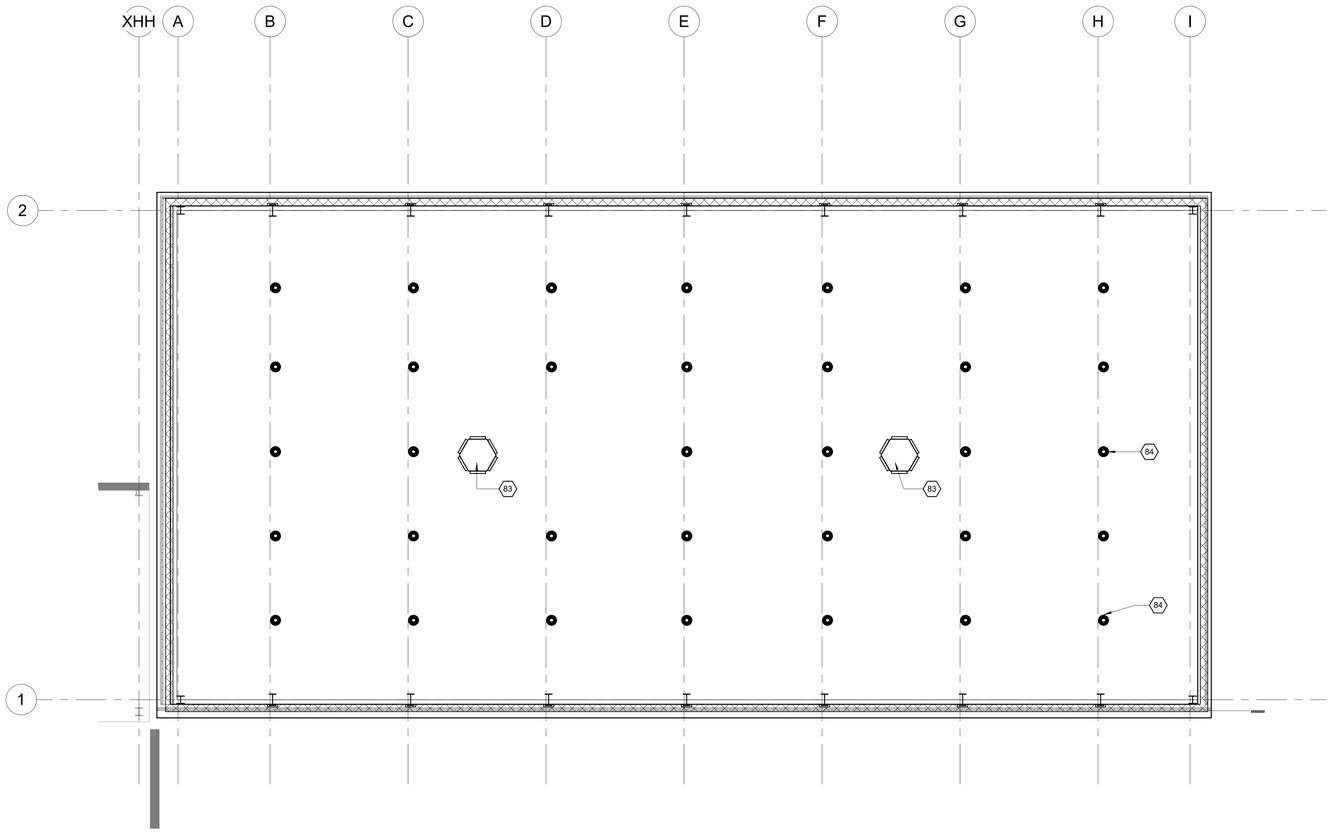

1 HOME BATTING ARENA RCP
SCALE: 1/8" = 1'-0"

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- RECESSED DOWNLIGHT
- RECESSED WALL WASHER
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KEYNOTES

83 HIGH CAPACITY VENTILATION SUPPLY MODULE
84 HIGH BAY COMPACT LIGHT FIXTURE

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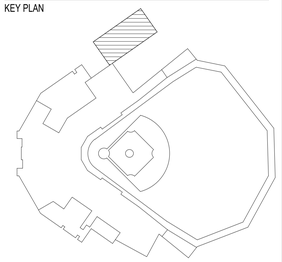

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

8400 HOBBS ROAD,
SALISBURY, MD, 21804

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PROJECT NO. 20230573 SCALE 1/8" = 1'-0"
DRAWING NAME

BATTING ARENA RCP

PHASE CD
DRAWING NO. A7.2

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ROOM #	ROOM NAME	FINISHES			
		FLOOR	BASE	WALL	CLG
DUGOUT					
202	STORAGE	SC	NONE	PT6	PT6
203	STORAGE	SC	NONE	PT6	PT6
CLUBHOUSE & BATTING ARENA					
108	FEMALE UMPIRE FACILITIES	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
109	TOILET	PCT1	WB2	PT2	PT6
111	UMPIRE LOUNGE	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
113	MALE UMPIRE FACILITIES	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
115	CIRCULATION	CPT1	WB1	PT1	APC1
116	VISITOR MALE COACHES	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
117	SHOWERS/GROOMING	PCT1/PCT2	WB2	PT2	PT6
120	CIRCULATION	CPT1	WB1	PT1	APC1
123	VISITOR LOCKER ROOM	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
124	VISITOR GROOMING	PCT1/PCT2	WB2	PT2	PT6
125	SHOWERS	PCT1/PCT2	WB2	PT2	PT6
125A	JANITOR	SC	WB1	PT1	N/A
126	VISITOR LAUNDRY	SC	WB1	PT1	N/A
127	CIRCULATION	CPT1	WB1	PT1	APC1
129	PLUMBING	SC	WB1	PT1	N/A
133	CONCESSIONS COLD STORAGE	SC	WB1	PT1	N/A
149	HYDRO	CPT1/LVT1	WB1	PT1	APC1
151	MULTI-PURPOSE DOC OFFICE	C	WB1	PT1	APC1
158	HOME TRAINING ROOM				
159	HOME LAUNDRY	SC	WB1	PT1	N/A
160	CIRCULATION	CPT1	WB1	PT1	APC1
161	TRAINER'S OFFICE	C	WB1	PT1	APC1
162	SHOWERS	PCT1/PCT2	WB2	PT2	PT6
163	JANITOR	SC	WB1	PT1	N/A
164	HOME GROOMING	PCT1/PCT2	WB2	PT2	PT6
165	RESTROOM	PCT1	WB2	PT2	PT6
166	HOME LOCKER ROOM	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
167	FLEX SPACE/NAP ROOM	CPT1/LVT1	WB1	PT1	APC1
168	CIRCULATION	CPT1	WB1	PT1	APC1
169	HOME MANAGER'S OFFICE	C	WB1	PT1	APC1
169A	TOILET	PCT1	WB2	PT2	PT6
169B	CLOSET	SC	WB1	PT1	N/A
172	FEMALE LOCKER ROOM	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
172A	TOILET	PCT1	WB2	PT2	PT6
174	UNFINISHED SPACE	N/A	N/A	N/A	N/A
175	SPRINKLER & MECH	SC	WB1	PT1	N/A
180	ELECTRICAL	SC	WB1	PT1	N/A
181	TOILET ROOM	PCT1	WB2	PT2	PT6
182	SHARED WEIGHT ROOM	RAF1/SYT1	WB1	PT1	APC1
183	WEIGHT OFFICE	C	WB1	PT1	APC1
184	EQUIPMENT	SC	WB1	PT1	N/A
185	CIRCULATION	CPT1	WB1	PT1	APC1
186	SHOWERS/ GROOMING	PCT1/PCT2	WB2	PT2	PT6
187	COACHES LOCKERS	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
188	CIRCULATION	CPT1	WB1	PT1	APC1
189	OPEN OFFICE	C	WB1	PT1	APC1
190	MLB STORAGE	SC	WB1	PT1	N/A
191	DINING	LVT1	WB1	PT1	APC1
192	STORAGE	SC	WB1	PT1	N/A
192	SHARED BATTING TUNNELS	SYT1	WB1	PT7	PT6
193	TURF TRAINING CLASSROOM	CPT1/LVT1	WB1	PT1	APC1
194	IT ROOM				
195	CIRCULATION	CPT1	WB1	PT1	APC1
196	DINING ROOM	LVT1	WB1	PT1	APC1
197	HYDRO	PCT2	WB2	PT2	PT6
198	TRAINING ROOM	CPT1/LVT1	WB1	PT1	APC1
199	VISITOR FEMALE COACHES	CPT2/CPT3/ (CPT4 HOME)	WB1	PT1	APC1
200	TOILET	C	WB1	PT1	APC1
201	VISITING MANAGER	C	WB1	PT1	APC1
204	CIRCULATION	CPT1	WB1	PT1	APC1
205	CIRCULATION	CPT1	WB1	PT1	APC1

MATERIAL CODES

APC	ACOUSTICAL PANEL CEILING
AS	ANTO SKID FLOOR COATING
CPT	CARPET
LVT	LUXURY VINYL TILE
PT	PAINT
PCT	PORCELAIN TILE
RAF	RUBBER ATHLETIC FLOORING
SYT	SYNTHETIC TURF
SC	SEALED CONCRETE
WB	WALL BASE

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 3" = 1'-0"

DRAWING NAME

FINISH SCHEDULE

PHASE CD

DRAWING NO. A9.1.1

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GENERAL STRUCTURAL NOTES

GENERAL NOTES

1. ALL CONTRACTORS AND SUBCONTRACTORS ARE RESPONSIBLE FOR ADHERING TO THE REQUIREMENTS AS INDICATED IN THE STRUCTURAL NOTES FOR THIS JOB. FAILURE OF THE CONTRACTOR TO READ THE STRUCTURAL NOTES DOES NOT PERMIT THE CONTRACTOR TO DEVIATE FROM THEIR REQUIREMENTS.
2. THE STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE, AND, EXCEPT WHERE SPECIFICALLY SHOWN, DO NOT INDICATE THE METHOD OR MEANS OF CONSTRUCTION. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK AND SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, PROCEDURES, TECHNIQUES, AND SEQUENCE. ALL APPLICABLE SAFETY REGULATIONS TO BE FOLLOWED STRICTLY.
3. THE STRUCTURE HAS BEEN DESIGNED TO RESIST DESIGN LOADS ONLY AS A COMPLETED STRUCTURE. APPLICATIONS OF CONSTRUCTION LOADS TO THE PARTIALLY COMPLETED STRUCTURE SHALL BE CONSIDERED BY THE CONTRACTOR AND SO INCLUDED IN THE DESIGN OF SHORING, BRACING, FORMWORK, AND ANY OTHER SUPPORTING ELEMENTS PROVIDED FOR CONSTRUCTION OF THE STRUCTURE. DURING ERECTION AND UNTIL ALL PERMANENT CONNECTIONS ARE MADE, THE CONTRACTOR MUST PROVIDE TEMPORARY BRACING FOR THE STRUCTURE IN ALL DIRECTIONS.
4. NO FIELD MODIFICATIONS TO ANY STRUCTURAL COMPONENTS SHALL BE MADE WITHOUT PRIOR APPROVAL BY THE STRUCTURAL ENGINEER. THIS INCLUDES, BUT IS NOT LIMITED TO REVISIONS DUE TO MIS-LOCATION, MISFIT, OR ANY OTHER CONSTRUCTION ERRORS.
5. ALL CONSTRUCTION AND DEMOLITION SHALL COMPLY WITH ALL APPLICABLE NATIONAL, STATE, AND LOCAL CODES INCLUDING ALL OSHA REGULATIONS.
6. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT ALL PEOPLE WHO MAY BE ON OR NEAR THE WORK AREA, BY MAINTAINING A SAFE WORK AREA, SAFE WORKING CONDITIONS, AND LIMITING ACCESS TO THE WORK AREA.
7. CONTRACTOR IS FULLY RESPONSIBLE FOR HIS WORKERS' SAFETY, SAFETY EQUIPMENT, FIRST AID, AND EMERGENCY HANDLING PROCEDURES.
8. CONTRACTOR SHALL PERSONALLY SUPERVISE THE WORK AND SHALL BE PRESENT AT THE WORK SITE AT ALL TIMES DURING CONSTRUCTION WORK. CONTRACTOR SHALL PROVIDE ADEQUATE PERSONNEL FOR THE PROPER COORDINATION AND EXPEDITING OF THE WORK.
9. THESE DRAWINGS SHALL NOT BE SCALED FOR PURPOSES OF CONSTRUCTION.
10. DETAILS LABELED "TYPICAL DETAILS" OR DETAILS ON "TYPICAL DETAILS" SHEETS APPLY TO SITUATIONS THAT ARE THE SAME OR SIMILAR TO THOSE SPECIFICALLY DETAILED. SUCH DETAILS AND DIMENSIONS APPLY WHETHER OR NOT DETAILS ARE REFERENCED AT EACH LOCATION. IN ADDITION, SECTIONS SHOWN ON PLAN APPLY TO SIMILAR CONDITIONS THROUGHOUT THE BUILDING.
11. IN CASE OF CONFLICT BETWEEN STRUCTURAL DRAWINGS AND OTHER DRAWINGS OF THIS PROJECT, CONTRACTOR SHALL IMMEDIATELY CONTACT ARCHITECT FOR CLARIFICATION PRIOR TO START OF WORK. IN CASE OF CONFLICT BETWEEN STRUCTURAL DRAWINGS AND STRUCTURAL SPECIFICATIONS, CONTRACTOR SHALL IMMEDIATELY CONTACT ENGINEER FOR CLARIFICATION PRIOR TO START OF WORK.
12. VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS AT THE SITE BEFORE ORDERING ANY MATERIALS AND BEGINNING ANY WORK. SURVEY AND ESTABLISH THE EXISTING BUILDING DIMENSIONS WHERE NEW CONSTRUCTION ABUTS EXISTING BUILDINGS. THIS FIELD SURVEY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO THE FOLLOWING: DIMENSIONS OF EXISTING BUILDING FACE INCLUDING ALL FENESTRATIONS, PROJECTIONS, ETC, PLUMBNESS OF WALLS, FLOOR AND ROOF ELEVATIONS, AND ALL OTHER PERTINENT DIMENSIONS. THIS FIELD SURVEY SHALL BE FOR THE USE BY ALL CONTRACTORS AND SHALL BE SUBMITTED TO THE OWNER AND ENGINEER FOR RECORD ONLY.
13. PERFORM ALL WORK AND COORDINATE TO PROVIDE ALL OPENINGS SHOWN ON THE ARCHITECTURAL, STRUCTURAL, MECHANICAL, PLUMBING, AND ELECTRICAL DRAWINGS. PROVIDE FRAMING AND ALL CONNECTIONS AND COORDINATE THE SIZE AND LOCATION OF ALL OPENINGS. (NOTE - NOT ALL OPENINGS ARE SHOWN ON THE STRUCTURAL DRAWINGS.
14. ENSURE PROPER STORAGE OF MATERIAL IS MAINTAINED SO AS NOT TO CAUSE OVERLOADING OF THE EXISTING OR NEW STRUCTURE DURING PERFORMANCE OF THIS WORK.
15. IF THE EXISTING CONDITIONS DO NOT PERMIT THE INSTALLATION OF THE WORK IN ACCORDANCE WITH THE DETAILS AS SHOWN, NOTIFY THE ENGINEER IMMEDIATELY AND PROVIDE A SKETCH OF THE CONDITION WITH PROPOSED MODIFICATION TO THE DETAILS GIVEN ON THE CONTRACT DOCUMENTS. THE FINAL INSTALLATION SHALL BE DONE AS REQUIRED BY THE ENGINEER, AT NO ADDITIONAL COST TO THE OWNER.
16. WHERE ALTERATIONS INVOLVE THE EXISTING SUPPORTING STRUCTURE, PROVIDE ALL SHORING, BRACING, GUYS AND PROTECTION REQUIRED TO ENSURE THE STRUCTURAL INTEGRITY OF THE EXISTING BUILDING.
17. ALL NEW OPENINGS IN EXISTING CONCRETE FLOOR SLABS SHALL BE MADE USING A CONCRETE SAW. USE A DRILL OR CORED OPENING AT CORNERS TO PREVENT OVERCUTTING OF SAWCUTS AT CORNERS. WHERE CUTS BECOME ROUGH THEY SHALL BE MADE CLEAN WITH EPOXY CONCRETE TO THE REQUIRED OPENING SIZE.
18. COORDINATE ALL RELATED TRADE ACTIVITY REGARDING SHUT DOWNS, RE-ROUTING, TEMPORARY INSTALLATION, ETC. NECESSARY FOR THIS INSTALLATION WITH OWNER'S REPRESENTATIVE.
19. ESTABLISH SPECIFIC MEANS AND METHODS FOR INSTALLATION AND COORDINATE THE WORK FOR ALL CONTRACTORS AND COMPLY WITH OWNER'S REQUIREMENTS.
20. COORDINATE WITH EQUIPMENT MANUFACTURERS FOR EXACT SIZE, LOCATION, ETC. OF HOUSEKEEPING PADS, PITS, CAST-IN ITEMS, WALLS, ETC. BEFORE LAYOUT, ORDERING ANY MATERIAL OR COMMENCEMENT OF ANY WORK.
21. WHERE NOTED IN THE DRAWINGS, REINFORCEMENT BARS LOCATION VERIFICATION AT EXISTING CONCRETE CONSTRUCTION SHALL BE PERFORMED WITH THE USE OF X-RAY, GROUND PENETRATION RADAR (GPR), A PACHOMETER OR WITH OTHER MAGNETIC NON-DESTRUCTIVE TESTING DEVICE.

SPECIAL INSPECTION NOTES

1. SPECIAL INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH THE 2015 INTERNATIONAL BUILDING CODE. THE FOLLOWING SPECIAL INSPECTIONS ARE REQUIRED FOR THIS PROJECT.
   A. INSPECTION OF EARTHWORK
   B. INSPECTION OF CAST IN PLACE CONCRETE / REINFORCEMENT
   C. INSPECTION OF STRUCTURAL STEEL
   D. INSPECTION OF MASONRY
   E. POST-INSTALLED ANCHORS
2. SEE SPECIFICATION SECTION 014100 FOR ADDITIONAL INSPECTION REQUIREMENTS.
3. EWINGCOLE WILL NOT PERFORM THE REQUIRED THIRD PARTY SPECIAL INSPECTION AS PART OF DESIGN SERVICES. THE ARCHITECT/ENGINEER MAY VISIT THE SITE TO ASCERTAIN GENERAL CONFORMANCE TO THE CONTRACT DOCUMENTS. HOWEVER, SUCH OBSERVATION SHALL NOT BE RELIED UPON BY OTHERS AS ACCEPTANCE OF THE WORK, NOR SHALL IT BE CONSTRUED TO RELIEVE THE CONTRACTOR IN ANY WAY FROM OBLIGATIONS AND RESPONSIBILITIES UNDER THE CONSTRUCTION CONTRACT.

FOUNDATION NOTES

1. ALL NEW BUILDING FOUNDATIONS SHALL BEAR ON UNDISTURBED STRATUM OR STRUCTURAL FILL HAVING A MINIMUM ALLOWABLE BEARING PRESSURE OF 3000 PSF . ALL NEW SITE RETAINING WALL FOOTINGS TO BEAR ON UNDISTURBED STRATUM OR STRUCTURAL FILL HAVING A MINIMUM ALLOWABLE BEARING PRESSURE OF 2,000 PSF. BEARING CONDITIONS ARE TO BE VERIFIED IN THE FIELD BY A GEOTECHNICAL ENGINEER HIRED BY THE OWNER, UNLESS OTHERWISE NOTED.
2. ALL COLUMN FOOTINGS SHALL BE CENTERED ON THE COLUMN CENTERLINES, UNLESS OTHERWISE NOTED.
3. PROVIDE ALL DEWATERING AS REQUIRED DURING THE EXCAVATION AND CONSTRUCTION OF THE FOUNDATION WORK INCLUDING PREVENTIVE MEASURES RELATED TO EXCAVATION STABILITY, SEE SPECIFICATIONS.
4. STANDARD PROCEDURES FOR FROST PROTECTION OF FOUNDATIONS AND EXCAVATIONS SHALL BE EMPLOYED FOR WINTER CONSTRUCTION. BACKFILLING OF EXCAVATIONS SHALL BE DONE AS SOON AS POSSIBLE TO PROTECT FOUNDATIONS FROST.
5. ELEVATIONS FOR FOUNDATIONS HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND ARE INDICATED ON THE FOUNDATION PLANS. BOTTOM OF ALL EXTERIOR FOOTINGS SHALL BE A MINIMUM OF 2'-0" BELOW FINISHED GRADE UNLESS OTHERWISE NOTED. SHOULD IT BE FOUND NECESSARY TO MODIFY THE ELEVATIONS GIVEN TO SATISFY THE FOUNDATION REQUIREMENTS, THE ARCHITECT, STRUCTURAL AND GEOTECHNICAL ENGINEER SHALL BE NOTIFIED BEFORE PROCEEDING WITH THE WORK.
6. ALL OVER EXCAVATION AND DISTURBED EARTH UNDER FOOTINGS SHALL BE REPLACED WITH CONCRETE OR STRUCTURAL FILL APPROVED BY A GEOTECHNICAL ENGINEER.
7. MINIMUM SUBGRADE PREPARATION REQUIREMENTS ARE AS FOLLOWS: COMPACT ALL FILL UNDER BUILDING TO 98% MAXIMUM DENSITY AS DETERMINED BY ASTM D1557. PLACE IN LAYERS OF 8" MAXIMUM LOOSE THICKNESS. VERIFY FIELD DENSITY, ASTM D1556, WITH AT LEAST ONE TEST PER 2,000 SQUARE FEET PER LAYER. SEE SPECIFICATIONS FOR OTHER TESTING REQUIREMENTS.
8. ALL EXISTING UNDERGROUND UTILITIES IN THE AREA OF THE NEW CONSTRUCTION SHALL BE RELOCATED UNLESS OTHERWISE NOTED ON THE DRAWINGS BEFORE ANY NEW FOUNDATION WORK IS STARTED. EXISTING SITE ELEMENTS AND UTILITIES, MANHOLES, CATCH BASINS, ETC. ADJACENT TO NEW CONSTRUCTION EXCAVATIONS SHALL BE PROTECTED BY SHEETING AND/OR SHORING. THIS PROTECTION SHALL BE PROVIDED AND DESIGNED BY THE GENERAL CONTRACTOR AND HIS REGISTERED PROFESSIONAL ENGINEER, LICENSED IN THE STATE OF THE PROJECTS JURISDICTION WHO SHALL BE TOTALLY RESPONSIBLE FOR ITS DESIGN AND INSTALLATION.
9. COORDINATE ALL FOUNDATION WORK WITH ALL UNDERGROUND UTILITIES. ALL NEW UNDERGROUND UTILITIES OR PIPES SHALL NOT BE PLACED BELOW SPREAD FOOTINGS. IF ANY SUCH CONDITION OCCURS, NOTIFY THE ENGINEER AND DROP THE BOTTOM OF FOOTING TO CLEAR THE PIPE AT NO ADDITIONAL COST TO THE OWNER.
10. CONTRACTOR SHALL EXERCISE EXTREME CAUTION DURING NEW FOUNDATION CONSTRUCTION ACTIVITIES ADJACENT TO EXISTING BUILDING FOUNDATIONS THAT ARE TO REMAIN. SINCE DRAWINGS FOR EXISTING CONSTRUCTION ARE NOT ALWAYS AVAILABLE DURING DESIGN, CERTAIN ASSUMPTIONS MAY BE MADE REGARDING EXISTING FOUNDATIONS BASED ON TYPICAL CONSTRUCTION PRACTICES. THESE ASSUMPTIONS TYPICALLY REQUIRE CONTRACTOR FIELD VERIFICATION PRIOR TO CONSTRUCTION OF THE NEW STRUCTURES. IN ANY EVENT, THE ENGINEER MUST BE NOTIFIED IMMEDIATELY IF EXISTING SITE OR FOUNDATION CONDITIONS DIFFER FROM THOSE SHOWN OR ASSUMED ON THE CONTRACT DRAWINGS. IN NO INSTANCE SHALL EXISTING BUILDING FOUNDATIONS BE UNDERMINED TO INSTALL NEW FOUNDATIONS. IF NEW BOTTOM OF FOOTING ELEVATIONS ARE LOWER THAN ADJACENT EXISTING BOTTOM OF FOOTING ELEVATIONS THE ENGINEER MUST BE NOTIFIED IMMEDIATELY TO PROVIDE ADDITIONAL DETAILS AS REQUIRED TO CONSTRUCT THE NEW FOUNDATIONS AT THE LOWER LEVEL.
11. BACKFILL AGAINST WALLS SHALL FOLLOW THE CRITERIA NOTED. AS A MINIMUM, WALLS MUST HAVE REACHED THEIR 28 DAY DESIGN STRENGTH OR BE IN PLACE 14 DAYS, WHICHEVER IS LONGER. FOR EXTERIOR AND INTERIOR BASEMENT WALLS, BACKFILL SHALL BE PLACED EVENLY ON BOTH SIDES TO THE FLOOR SUBGRADE LEVEL. EQUIPMENT USED TO COMPACT THE BACKFILL WILL BE SUCH AS TO LIMIT PRESSURES ON THE WALLS TO THE DESIGN VALUES AND TO BE REVIEWED AND ACCEPTED BY THE OWNER'S GEOTECHNICAL ENGINEER.
12. PROVIDE STANDARD STEEL PIPE SLEEVES FOR ALL PIPES PASSING THROUGH NEW CONCRETE WALLS AND NEATLY CORED HOLES A MINIMUM OF ONE PIPE SIZE LARGER THAN NEW PIPE THROUGH EXISTING CONCRETE WALLS WHERE SHOWN ON THE DRAWINGS. COORDINATE CORED HOLES WITH SEALANT, ETC., REQUIREMENTS WITH RELATED SPECIFICATIONS. SEE TYPICAL DETAIL ON DRAWING S5.1.
13. WHERE THE EXCAVATION FOR SERVICE LINE TRENCHES IS LOWER THAN AND CLOSER THAN A 1.5H:1V SLOPE TO THE BOTTOM OF A NEW OR EXISTING COLUMN OR WALL FOOTING, BACKFILL THE EXCAVATION WITH LEAN MIX CONCRETE. TOP OF FILL TO BE ON A 1.5H:1V SLOPE FROM BOTTOM OF ADJACENT FOUNDATIONS.
14. THE TEST BORINGS FOR THIS PROJECT WERE PERFORMED BY:
    GEO-TECHNOLOGY ASSOCIATES, INC.
    21491 BALTIMORE AVENUE, UNIT 1
    GEORGETOWN DE 19947
    REPORT DATED JUNE 19, 2024
    A COPY OF THE SOILS AND FOUNDATION INVESTIGATION ANALYSIS REPORT IS INCLUDED IN THE SPECIFICATION FOR INFORMATION ONLY.
15. FOR ADDITIONAL REQUIREMENTS SEE TYPICAL DETAILS AND THE SPECIFICATIONS.

TEMPORARY STRUCTURES AND DELEGATED DESIGN

1. VERIFY ALL EXISTING CONDITIONS RELATED TO THIS WORK PRIOR TO BEGINNING ANY WORK OR ORDERING ANY MATERIAL.
2. COORDINATE ALL RELATED TRADE ACTIVITY REGARDING SHUT DOWNS, RE-ROUTING, TEMPORARY INSTALLATION, ETC. NECESSARY FOR THIS INSTALLATION WITH OWNER'S REPRESENTATIVE.
3. PERFORM TEMPORARY SHEETING, SHORING, AND BRACING WORK AS SHOWN ON DRAWINGS AND AS REQUIRED BY EXISTING FOUNDATION CONDITIONS AND CONSISTENT WITH THE GEOTECHNICAL CONDITIONS AS DESCRIBED IN THE GEOTECHNICAL INVESTIGATION REPORT BY THE GEOTECHNICAL ENGINEER. TEMPORARY STRUCTURES SHALL BE INSTALLED/EXCAVATED WITH EXTREME CARE SO AS NOT TO DISTURB EXISTING FOUNDATIONS, SLABS AND UNDERGROUND UTILITIES TO REMAIN. WHERE REQUIRED, ALL EXISTING UNDERGROUND UTILITIES WHICH REMAIN IN PLACE AND IN OPERATION DURING THE EXCAVATIONS AND CONSTRUCTION SHALL BE TEMPORARILY SHORED AND BRACED.
4. THE SHEETING, SHORING, AND BRACING WORK SHALL BE DESIGNED TO WITHSTAND ALL LATERAL LOADS INCLUDING SURCHARGE OF EXISTING FOUNDATIONS OF ADJACENT STRUCTURES, ROAD, CONSTRUCTION EQUIPMENT, ETC. REVIEW DESIGN CRITERIA PARAMETERS WITH THE OWNER'S GEOTECHNICAL ENGINEER. THIS SHEETING, SHORING, AND BRACING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER. THE PROFESSIONAL ENGINEER SHALL HAVE A MINIMUM OF 5 YEARS OF DESIGN EXPERIENCE, BE REGISTERED AND LICENSED IN THE STATE OF THE PROJECT'S JURISDICTION AND BE HIRED BY THE CONTRACTOR. THE CONTRACTOR'S ENGINEER SHALL BE REQUIRED TO INSPECT THE SHEETING, SHORING, AND BRACING WORK ON A FULL-TIME BASIS AND SHALL BE TOTALLY RESPONSIBLE TO GIVE ALL DIRECTION REGARDING HIS DESIGNED SYSTEM, SAFETY ASPECTS AND MEANS AND METHODS OF CONSTRUCTION FOR THE PERFORMANCE OF THE SHEETING, SHORING, AND BRACING WORK. THE CONTRACTOR'S ENGINEER SHALL PROVIDE THE OWNER WITH ONE SET OF SEALED DRAWINGS AND CALCULATIONS INDICATING THE EXTENT AND RELATED DETAILS FOR THE TEMPORARY SHEETING, SHORING, AND BRACING SYSTEMS. THE REVIEW OF ANY SUBMITTAL BY EWINGCOLE WILL BE FOR INFORMATION AND RECOMMENDATION ONLY AND WILL NOT RELIEVE THE GENERAL CONTRACTOR OR DESIGN ENGINEER FROM ANY DESIGN OR CONSTRUCTION RESPONSIBILITIES OR LIABILITY. ANY RECOMMENDATION ADOPTED BY THE GENERAL CONTRACTOR SHALL BE AT THE CONTRACTOR'S SOLE RISK, COST AND EXPENSE.
5. TESTING AND INSPECTION OF MATERIAL AND PLACEMENT INVOLVING THE SHEETING, SHORING, AND BRACING WORK WILL BE PERFORMED BY THE OWNER'S TESTING AND INSPECTION AGENCY AND THE OWNER'S GEOTECHNICAL ENGINEER AS REQUIRED.
6. COORDINATE ALL SHEETING, SHORING, AND BRACING WORK TO ENSURE THAT THE SHEETING, SHORING, AND BRACING WORK DOES NOT INTERFERE WITH THE PERMANENT BUILDING ELEMENTS. WHERE REQUIRED PROVIDE OPENINGS THROUGH WALL, ETC FOR BRACING AND PROVIDE REPAIR UPON REMOVAL OF BRACING.
7. TEMPORARY SUPPORT SHALL NOT BE REMOVED UNTIL PERMANENT WORK HAS BEEN INSTALLED, FULLY INSPECTED AND ANY CORRECTIVE WORK COMPLETED.
8. TEMPORARY LATERAL BRACING OF THE BUILDING SUPERSTRUCTURE TO RESIST WIND AND SEISMIC FORCES DURING CONSTRUCTION SHALL BE PROVIDED BY THE CONTRACTOR. THIS BRACING SHALL BE PROVIDED FOR STEEL FRAMING, CONCRETE WALLS, AND CMU WALLS UNTIL ALL CONNECTIONS BETWEEN THESE ELEMENTS TO THE STRUCTURAL FRAME HAVE BEEN COMPLETED AND THE PERMANENT LATERAL BRACING CONNECTIONS FOR THE STRUCTURE ARE COMPLETE.
9. PROPER WEIGHT DISTRIBUTION OF CONSTRUCTION MATERIALS DURING CONSTRUCTION IS THE RESPONSIBILITY OF THE CONTRACTOR. DO NOT STACK CONSTRUCTION MATERIALS ON UNBRACED FRAMING. AVOID STACKING HEAVY CONSTRUCTION MATERIALS AT MID-SPAN OF FRAMING. HEAVY CONSTRUCTION MATERIALS SHOULD BE STORED AT GROUND LEVEL AND ONLY MOVED TO ELEVATED FLOOR AND ROOF LOCATIONS WHEN REQUIRED FOR INSTALLATION.
10. SINCE LIMITED DRAWINGS FOR THE EXISTING BUILDING WERE AVAILABLE DURING DESIGN, CERTAIN ASSUMPTIONS WERE MADE REGARDING EXISTING CONSTRUCTION. THESE ASSUMPTIONS TYPICALLY REQUIRE CONTRACTOR FIELD VERIFICATION PRIOR TO CONSTRUCTION OF THE NEW STRUCTURES. IN ANY EVENT, THE ENGINEER MUST BE NOTIFIED IMMEDIATELY IF EXISTING CONDITIONS DIFFER FROM THOSE SHOWN OR ASSUMED ON THE CONTRACT DRAWINGS. IN NO INSTANCE SHALL THE EXISTING BUILDING BE MODIFIED IF EXISTING CONDITIONS DIFFER FROM THOSE DEPICTED ON THE CONTRACT DOCUMENTS. THE ENGINEER MUST BE NOTIFIED IMMEDIATELY TO PROVIDE ADDITIONAL DETAILS AS REQUIRED IF EXISTING CONDITIONS DIFFER FROM THOSE DOCUMENTED ON THE CONTRACT DOCUMENTS.
11. THE DESIGN OF LOAD BEARING COLD FORMED METAL STUD AND JOISTS SHALL BE PERFORMED BY ENGINEERS RETAINED BY THE CONTRACTOR. DRAWINGS AND CALCULATIONS FOR THESE WALLS SHALL BE PREPARED AND SUBMITTED FOR REVIEW. ALL SUBMITTALS SHALL BE SIGNED AND SEALED BY ENGINEERS LICENSED IN THE STATE OF THE PROJECT'S JURISDICTION. DESIGN OF WALL SYSTEM AND CONNECTIONS SHALL CONSIDER ALL VERTICAL AND LATERAL LOADS REQUIRED BY THE APPLICABLE BUILDING CODE.
12. RAILINGS, GUARDRAILS, AND LADDERS SHALL BE DESIGNED BY ENGINEERS RETAINED BY THE CONTRACTOR. DRAWINGS AND CALCULATIONS FOR THESE ITEMS SHALL BE PREPARED AND SUBMITTED FOR REVIEW. ALL SUBMITTALS SHALL BE SIGNED AND SEALED BY ENGINEERS LICENSED IN THE STATE OF THE PROJECTS JURISDICTION. DESIGNS ARE THE RESPONSIBILITY OF THE ENGINEER RETAINED BY THE CONTRACTOR AND SHALL BE IN ACCORDANCE WITH ALL LOADS REQUIRED BY THE APPLICABLE BUILDING CODE. REVIEW OF SHOP DRAWINGS FOR THESE ITEMS WILL BE FOR CONCEPT ONLY AND WILL NOT BE A CHECK OF THE DESIGN OF THESE ITEMS. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR ALL LOCATIONS, DIMENSIONS, AND DETAILS.
13. EWINGCOLE REVIEW OF DELEGATED DESIGN SUBMITTALS PREPARED BY CONTRACTOR-RETAINED ENGINEERS IS LIMITED TO AN EVALUATION OF WHETHER THE DESIGN SUBMITTED CONFORMS TO THE SPECIFIED DESIGN CRITERIA. THE DESIGN OF THESE DELEGATED DESIGN STRUCTURES REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL PREPARING THE CALCULATIONS AND SUBMITTALS.

DELEGATED DESIGN TABLE

1	EXCAVATION SUPPORT - SHEETING, SHORING, TEMPORARY BRACING, SUPPORT FOR CONSTRUCTION EQUIPMENT SURCHARGE LOADS
2	STRUCTURAL CONCRETE - FORMS AND TEMPORARY BRACING
3	MEANS AND METHODS - BUILDING SHORING DURING CONSTRUCTION, SCAFFOLDING, FALL PROTECTIONS, TEMPORARY SUPPORTS, RIGGING HOISTS AND CRANES
4	STEEL CONSTRUCTION - CONNECTION DESIGN, LADDERS, RAILINGS, GUARDRAILS, ETC.
5	COLD-FORMED METAL FRAMING - LOAD-LOAD BEARING METAL STUD & JOISTS
6	SUPPORT OF UTILITIES, PIPING, DUCTWORK, CONDUIT, ETC. ATTACHED TO THE BUILDING STRUCTURE.
7	MASONRY - TEMPORARY MASONRY SHORING
8	UNISTRUT FRAMING SYSTEM FOR MISCELLANEOUS SUPPORT

THE ITEMS LISTED IN THE TABLE ABOVE HAVE NOT BEEN DESIGNED BY THE STRUCTURAL ENGINEER OF RECORD. CONTRACTOR TO RETAIN A PROFESSIONAL ENGINEER LICENSED IN THE COMMONWEALTH OF PENNSYLVANIA TO DESIGN THE SPECIALTY ITEMS LISTED IN THIS TABLE. THE CONTRACTOR SHALL SUBMIT THE SIGNED AND SEALED DESIGN CALCULATIONS AND SHOP DRAWINGS FOR DELEGATED DESIGN ELEMENTS TO THE ARCHITECT FOR REVIEW OF DESIGN CRITERIA AND RECORD.

STRUCTURAL STEEL NOTES

1. ALL STRUCTURAL STEEL TO CONFORM TO THE FOLLOWING:
   - WIDE FLANGE FRAMING — ASTM A992 GRADE 50
   - BASE PLATES, MOMENT PLATES AND SPLICE PLATES — ASTM A572 GRADE 50
   - HOLLOW STRUCTURAL STEEL FRAMING — ASTM A500 GRADE C
   - ANGLES, CHANNELS AND OTHER PLATES — ASTM A572 GRADE 50
2. VERIFY IN THE FIELD BY A SURVEY ALL EXISTING CONDITIONS CONNECTED WITH HIS WORK INCLUDING ANCHOR BOLT LOCATIONS PRIOR TO ORDERING ANY MATERIAL OR COMMENCEMENT OF ANY WORK.
3. STEEL JOISTS TO BE DESIGNED AND MANUFACTURED PER THE LATEST EDITION OF THE STANDARD SPECIFICATION FOR STEEL JOISTS PUBLISHED BY THE STEEL JOIST INSTITUTE (SJI). SEE DESIGN CRITERIA FOR LOAD REQUIREMENTS. ALL STEEL JOISTS MANUFACTURERS TO BE APPROVED MEMBERS OF SJI. THE MANUFACTURER SHALL SUBMIT SHOP DRAWINGS AND CALCULATIONS SEALED BY AN ENGINEER LICENSED IN THE STATE OF THE PROJECT.
4. PROVIDE SATISFACTORY BRACING OF THE NEW STEEL FRAME UNTIL ALL NEW FRAMING AND THE METAL DECK IS ERECTED AND FINAL CONNECTIONS ARE COMPLETE.
5. ALL STRUCTURAL STEEL DIRECTLY EXPOSED TO THE WEATHER SHALL BE HOT DIPPED GALVANIZED AND TOUCHED UP WITH ZRC WHERE ABRADED OR AFTER WELDING (SEE SPECIFICATIONS).
6. MAIN SUPPORT MEMBERS FOR THE METAL DECK ARE SHOWN ON THE CONTRACT DRAWINGS. DURING PREPARATION, SUBMISSION, AND REVIEW OF SHOP DRAWINGS ANY ADDITIONAL SUPPORT OR ATTACHMENT DETAILS REQUIRED TO ESTABLISH THE METAL DECK AT THE REQUIRED ELEVATION SHALL BE PROVIDED BY THE STRUCTURAL STEEL CONTRACTOR AT NO ADDITIONAL COST.
7. STRUCTURAL STEEL ERECTOR: NOTE THAT SEQUENCE OF ERECTION TO BE COORDINATED AS REQUIRED FOR AREAS SUPPORTED BY CANTILEVERS. ALL MOMENT CONNECTIONS AND/OR OTHER CONNECTIONS FOR CANTILEVERED FRAMING SHALL HAVE TEMPORARY BRACING OR SHORING TO SUPPORT CANTILEVERED FRAMING UNTIL ALL FINAL CONNECTIONS ARE COMPLETED, BACKSPAN IN PLACE AND SLAB AND DECK INSTALLED AND INSPECTED BY THE TESTING AND INSPECTION AGENCY, AND THE RESULTS ACCEPTED PRIOR TO ERECTING FRAMING SUPPORTED BY THE CANTILEVER ENDS.
8. ALL MASONRY AND BRICK ANCHORS SHALL BE SHOP WELDED TO THE STRUCTURAL STEEL FRAMING AND COLUMNS. SEE SPECIFICATIONS FOR SPACING ETC.
9. ANY FIELD WELDING TO ANY EXISTING JOIST OR OTHER THIN MEMBER SHALL BE PERFORMED WITH EXTREME CARE SO AS TO AVOID EXCESSIVE DAMAGE TO THE BASE METAL.
10. FOR ADDITIONAL REQUIREMENTS, SEE TYPICAL DETAILS AND THE SPECIFICATIONS.

METAL DECK NOTES

1. ALL METAL DECK SHALL CONFORM TO THE REQUIREMENTS OF THE STEEL DECK INSTITUTE (SDI).
2. FOR ADDITIONAL INFORMATION SEE THE SPECIFICATIONS.

CONCRETE NOTES

1. ALL CONCRETE SHALL BE READY-MIX. ALL CONCRETE MIX DESIGNS SHALL BE DESIGNED BY ENGINEERS RETAINED BY THE CONCRETE SUPPLIER ACCORDING TO THE CRITERIA CONTAINED WITHIN THESE NOTES AND AS SHOWN ON THE STRUCTURAL DRAWINGS. SUBMIT ALL CONCRETE MIX DESIGNS TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION. ALL SUBMITTED MIX DESIGNS SHALL INCLUDE SAMPLE CYLINDER BREAK TEST RESULTS CONFIRMING COMPRESSIVE STRENGTH OF EACH MIX DESIGN.
2. ALL CONCRETE SHALL HAVE A WATER REDUCING ADMIXTURE AS REQUIRED TO INCREASE WORKABILITY. WORKABILITY SHALL NOT BE ACHIEVED THROUGH THE ADDITION OF WATER TO THE MIX. CONCRETE SLUMP PRIOR TO ADMIXTURE ADDITION SHALL BE A MAXIMUM OF 3 INCHES. PROPORTIONS OF CONCRETE ADMIXTURES SHALL BE DETERMINED BY THE CONCRETE MIX DESIGNER.
3. DO NOT USE ADMIXTURES THAT CONTAIN CHLORIDES.
4. ALL CONCRETE WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE LATEST EDITIONS OF THE FOLLOWING ACI PUBLICATIONS ACI 301 (SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS), ACI 302 (RECOMMENDED PRACTICE FOR CONCRETE FLOOR AND SLAB CONSTRUCTION), ACI 304 (ACI MANUAL OF CONCRETE INSPECTION), ACI 311 (RECOMMENDED PRACTICE FOR MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE), ACI 315 (DETAILS AND DETAILING OF CONCRETE REINFORCEMENT), ACI 318 (BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE), ACI 347 (RECOMMENDED PRACTICE FOR CONCRETE FORMWORK), AND ACI 546 (CONCRETE REPAIR GUIDE). IN ADDITION, REFER TO THE CRSI - MANUAL OF STANDARD PRACTICE FOR DETAILS ON THE FABRICATION AND PLACEMENT OF CONCRETE REINFORCING.
5. PRIOR TO FABRICATION OR SHIPMENT OF MATERIAL, THE CONTRACTOR SHALL SUBMIT AND RECEIVE APPROVAL OF SHOP DRAWINGS. SHOP DRAWINGS SHALL INDICATE BENDING DIAGRAMS, SPLICING, LAPPING, SHAPES, DIMENSIONS AND DETAILS OF ALL BAR REINFORCING. THE APPROVAL OF SHOP DRAWINGS WILL BE FOR ARRANGEMENT ONLY AND SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY FOR ERRORS, OMISSIONS OR THE ACCURACY OF HIS OWN DIMENSIONS. DRAWINGS AND DETAILS SHALL CONFORM WITH ACI 315. CONTRACTOR SHALL SUBMIT ALL SHOP DRAWINGS TO THE ARCHITECT.
6. ALL REINFORCING STEEL SHALL BE MANUFACTURED FROM HIGH STRENGTH BILLET STEEL CONFORMING TO ASTM DESIGNATION A-615 GRADE 60. WWF SHALL BE COMPRISED OF CARBON STEEL PLAIN WIRES FABRICATED INTO SHEETS OR ROLLS IN ACCORDANCE WITH ASTM A1064.
7. ALL CONCRETE WORK SHALL BE CURED FOR A MINIMUM OF 7 DAYS IN ACCORDANCE WITH ACI STANDARDS.
8. ALL CONCRETE USED TO PATCH EXISTING FLOOR SLABS SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS. THE CONCRETE TYPE (NORMAL WEIGHT OR LIGHTWEIGHT) SHALL BE THE SAME AS THE EXISTING ADJACENT CONCRETE.
9. VERIFY THE DIMENSIONS OF AND INSTALL IN THE FORMS ALL SLOTS, SLEEVES, ANCHOR BOLTS, MASONRY ANCHORS, POCKETS, ETC. AS REQUIRED FOR OTHER TRADES.
10. SEE MECHANICAL AND ELECTRICAL DRAWINGS FOR CONCRETE EQUIPMENT PADS AND FOUNDATIONS REQUIRED.
11. SEE SECTIONS AND DETAILS FOR ALL EQUIPMENT OPENINGS, DEPRESSIONS, ETC. COORDINATE EQUIPMENT REQUIREMENTS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING CONTRACTORS.
12. FOOTING, SLAB, AND WALL REINFORCEMENT NOT SHOWN ON SECTIONS AND PLANS IS THE SAME AS THAT SHOWN IN SIMILAR SECTIONS AND AT SIMILAR LOCATIONS.
13. LAP ALL BARS PER THE SCHEDULES ON THE STRUCTURAL DRAWINGS. LAP ALL WWF A MINIMUM OF 6 INCHES.
14. CONTRACTOR SHALL PROVIDE ALL BOLSTERS, CHAIRS, BAR POSITIONERS, ETC. AS REQUIRED TO SET REBAR AND SLAB WWF TO REQUIRED DIMENSIONS INDICATED ON DRAWINGS.
15. REFER TO ARCHITECTURAL DRAWINGS FOR ALL WATERPROOFING DETAILS AT FOUNDATIONS, WALLS, AND SLABS.
16. CONCRETE CONTRACTOR SHALL PROVIDE ADDITIONAL SLAB REINFORCEMENT AT ALL CONCRETE SLAB RE-ENTRANT CORNERS. THIS REINFORCEMENT SHALL BE COMPRISED OF A #4 BAR x 4'-0" LONG LOCATED WITHIN 2 INCHES FROM THE TOP OF THE SLAB UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.
17. CONCRETE CONTRACTOR SHALL PROVIDE ADDITIONAL WALL REINFORCEMENT AT WALL OPENINGS AND POCKETS FOR STEEL FRAMING. THIS REINFORCING SHALL BE COMPRISED OF # 5 BARS LOCATED WITHIN 1 1/2" OF THE OPENING DIMENSION AND EXTENDING A MINIMUM OF 30 INCHES BEYOND THE EXTENT OF THE OPENING. THE ADDITIONAL BARS SHALL BE LOCATED HORIZONTALLY, VERTICALLY, AND DIAGONALLY AT THE CORNERS OF THE OPENING. PROVIDE ONE LAYER OF ADDITIONAL REINFORCING AT 8" WALLS AND TWO LAYERS (ONE ON THE INSIDE FACE AND ONE ON THE OUTSIDE FACE) OF WALLS WITH A THICKNESS OF 10 INCHES OR GREATER. FOR WALL POCKETS WITH BEARING PLATES AND ATTACHED HEADED STUDS, PROVIDE ADDITIONAL HORIZONTAL BARS BETWEEN THE FACE OF THE CONCRETE AND THE HEADED STUDS OF THE BEARING PLATE.
18. AT CONCRETE WALL INTERSECTIONS PROVIDE CORNER BARS EQUAL IN SIZE AND SPACING TO TYPICAL WALL REINFORCING STEEL.
19. ALL CONCRETE PLACED AT TEMPERATURES BELOW 50 DEGREES F. SHALL CONFORM TO THE REQUIREMENTS OF ACI 306 "COLD WEATHER CONCRETING". ALL CONCRETE PLACED IN HOT WEATHER SHALL CONFORM TO THE REQUIREMENTS OF ACI 305 "HOT WEATHER CONCRETING".
20. THE CONTRACTOR SHALL COORDINATE THE LOCATION OF ALL SLEEVES, INSERTS, ANCHOR BOLTS, AND OTHER EMBEDDED ITEMS AS REQUIRED BY OTHER TRADES.
21. ALL CONCRETE SHALL BE PROPERLY CONSOLIDATED THROUGH THE USE OF VIBRATORS. VIBRATORS SHALL NOT BE USED TO TRANSPORT CONCRETE ALONG FORMWORK.
22. FOR ADDITIONAL REQUIREMENTS, SEE TYPICAL DETAILS AND THE SPECIFICATIONS.
23. WALL FOOTING REINFORCING SHALL BE CONTINUOUS THROUGH ADJACENT COLUMN FOOTINGS.
24. EMBED PLATES MUST BE SET IN THE FORM BEFORE POURING CONCRETE, NOT PLACED INTO TOP OF WET CONCRETE. THE CONTRACTOR SHALL CONTACT THE ARCHITECT FOR CORRECTIVE DETAILS FOR ANY EMBED PLATES LEFT OUT OF CONCRETE POURS.
25. FOR SLABS ON GRADE AND FOOTING REINFORCING SHALL BE HELD IN PLACE BY BAR SUPPORTS WITH SAND PLATES, OR PRECAST CONCRETE BAR SUPPORTS AS DESCRIBED IN CHAPTER 3 OF THE CRSI MANUAL OF STANDARD PRACTICE. BAR SUPPORTS SHALL BE SPACED AT A MAXIMUM OF 4'-0"OC BOTH WAYS. ROCKS, CMU, OR CLAY BRICK SHALL NOT BE USED AS SUPPORTS.
26. REBAR SHALL NOT BE HEATED WITH A TORCH IN THE FIELD.

CONCRETE MIX DESIGN AND DURABILITY REQUIREMENTS PER ACI 318 BUILDING CODE

LOCATION	DENSITY NW=145pcf LW=120pcf	FREEZE / THAW SEVERITY	SULFATE SEVERITY	CONTACT WITH WATER	CHLORIDE SEVERITY	f'_c (PSI)	AIR CONTENT (±1.5%)	w/c RATIO (MAX)	GWP ($kgCO_2e/YD^3$)
PERIMETER FOUNDATIONS PIERS & PEDESTALS	NW	F2	S0	W1	C1	4,500	6%	0.45	260
PERIMETER FOUNDATION WALLS & RETAINING WALLS	NW	F2	S0	W1	C1	4,500	6%	0.45	260
INTERIOR FOUNDATIONS PIERS & PEDESTALS	NW	F0	S0	W0	C0	4,000	----	0.50	240
EXTERIOR SLAB ON GRADE	NW	F3	S0	W1	C2	5,000	6%	0.40	280
INTERIOR SLAB ON GRADE	NW	F0	S0	W0	C0	4,000	----	0.50	240
SITE RETAINING WALLS AND FOUNDATIONS	NW	F3	S0	W1	C2	5,000	6%	0.40	280
ALL CONCRETE EXPOSED TO FREEZE-THAW CONDITIONS	NW	F3	S0	W1	C2	5,000	6%	0.40	280
ALL OTHER CONCRETE	NW	F0	S0	W0	C0	4,000	----	0.50	240

A. CONCRETE MIX SHALL BE DESIGNED BY THE CONCRETE SUPPLIER USING THE INFORMATION CONTAINED IN THE ABOVE SCHEDULE.
B. REFER TO CHAPTER 4 OF THE ACI-318 BUILDING CODE FOR ADDITIONAL INFORMATION NOT PROVIDED OR NOTED IN THE ABOVE SCHEDULE.
C. TOTAL AIR CONSTANT LISTED IN THE ABOVE SCHEDULE IS BASED ON A MAXIMUM AGGREGATE SIZE OF 3/4" AND SHALL BE ADJUSTED BY THE CONCRETE MIX DESIGNER AS REQUIRED FOR DIFFERENT AGGREGATE SIZES PER ACI-318. DO NOT ALLOW AIR CONTENT OF TROWELED FINISHED FLOORS TO EXCEED 3 PERCENT.
D. REFER TO PROJECT SPECIFICATIONS FOR FLY ASH OR OTHER POZZOLANS LIMITATIONS.
E. "GWP" INDICATES THE TARGET MAXIMUM GLOBAL WARMING POTENTIAL OF THE CONCRETE MIX DESIGN AS DEMONSTRATED BY THE ENVIRONMENTAL PRODUCT DECLARATION FOR EACH MIX DESIGN. SEE SPECIFICATIONS FOR SUBMITTAL REQUIREMENTS.

CAST IN PLACE CONCRETE CLEAR COVER FOR REINFORCING

EXPOSURE CONDITION	CLEAR COVER	PLACEMENT TOLERANCE
CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH	3"	±3/8"
EXPOSED TO EARTH OR WEATHER: NO. 5 AND SMALLER BARS NO. 6 AND LARGER BARS	 1-1/2" 2"	 ±1/4" ±1/4"
NOT EXPOSED TO WEATHER OR IN CONTACT WITH THE GROUND: STRUCTURAL SLABS, WALLS, AND JOISTS BEAMS AND COLUMNS (PRIMARY REINF, TIES, & STIRRUPS)	 1-1/4" 1-3/4"	 ±1/4" ±1/4"
SLABS ON GRADE	1"	±1/4"

POST-INSTALLED ANCHORS

1. THE ADHESIVE ANCHOR SYSTEM USED FOR POST-INSTALLED ANCHORAGE TO CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF THE MOST RECENTLY PUBLISHED ACI 355.4, ACCEPTANCE CRITERIA FOR QUALIFICATION OF POST-INSTALLED ADHESIVE ANCHORS IN CONCRETE AND COMMENTARY.
2. THE ADHESIVE ANCHORS SHALL BE SUPPLIED AS AN ENTIRE SYSTEM. THE SYSTEM SHALL INCLUDE, BUT IS NOT LIMITED TO, THE NEW ADHESIVE CARTRIDGE, A CLEAN MIXING NOZZLE, EXTENSION TUBE, A DISPENSING GUN, AND ALL MANUFACTURER RECOMMENDED SUPPLIES FOR PROPERLY CLEANING THE DRILLED HOLE.
3. EYEBOLTS, THREADED STUDS, INTERNAL THREADED PARTS TO BE USED IN ADHESIVE ANCHOR ASSEMBLIES SHALL CONFORM TO ASTM A36, A193 (GRADE B7), A307, B348 (BD), OR F1554. STAINLESS STEEL ANCHOR RODS SHALL BE AISI TYPE 304 OR TYPE 316. THREADS SHALL BE UNC COARSE THREADS, UNLESS NOTED OTHERWISE. COMPATIBLE NUTS AND WASHERS SHALL BE FURNISHED WITH THE ALL-THREAD ROD AND CONSIDERED PART OF THE ASSEMBLY. THE COST OF THE HARDWARE SHALL BE CONSIDERED INCIDENTAL TO THE INSTALLED ADHESIVE ANCHOR ASSEMBLY.
4. NUTS, WASHERS, AND OTHER HARDWARE USED WITH AN ALL-THREADED BAR ADHESIVE ANCHOR SYSTEM SHALL HAVE A MATERIAL OR AN ALLOY DESIGNATION THAT MATCHES THE ALL-THREAD MATERIAL / ALLOY. GALVANIZED ASSEMBLIES SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A153 CLASS C. ELECTROPLATE GALVANIZING IS NOT ACCEPTABLE. DISSIMILAR METAL ASSEMBLIES SHALL BE SEPARATED BY NYLON, EPDM, OR OTHER APPROVED NON-METALLIC WASHERS.
5. REINFORCING BARS TO BE USED IN ADHESIVE ANCHORS ASSEMBLIES SHALL CONFORM TO ASTM A615.
6. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH (F'c) OF 2,500 PSI AT THE TIME OF ADHESIVE ANCHOR INSTALLATION.
7. CONCRETE AT TIME OF ADHESIVE ANCHOR INSTALLATION SHALL HAVE A MINIMUM AGE OF 21 DAYS.
8. CONCRETE TEMPERATURE AT THE TIME OF ADHESIVE ANCHOR INSTALLATION SHALL BE AT LEAST 50 DEGREES F.
9. EMBEDMENT DEPTH AND ANCHOR PROJECTION (STICK-OUT) FROM THE CONCRETE SURFACE SHALL BE AS SHOWN ON THE DRAWING OR DETAIL FOR THE PARTICULAR ANCHOR OR GROUP OF ANCHORS BEING INSTALLED. ABSENT ANY INFORMATION, THE MINIMUM EMBEDMENT DEPTH SHALL BE 10 TIMES THE ANCHOR DIAMETER IN INCHES AND MINIMUM STICK-OUT SHALL BE AS REQUIRED TO MAKE THE CONNECTION.
10. ADHESIVES SHALL BE STORED AND INSTALLED AT THE SERVICE TEMPERATURE RANGES RECOMMENDED BY THE MANUFACTURER.
11. ADHESIVE ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL ADHESIVE ANCHORS IN ACCORDANCE WITH THE REQUIREMENTS OF THE MANUFACTURER AND THE CONTRACT DOCUMENTS. POST-INSTALLED ADHESIVE ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
12. THE INSTALLER'S QUALIFICATIONS SHALL BE SUBMITTED AND APPROVED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
13. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT REQUIRED TO INSTALL THE ADHESIVE ANCHOR INCLUDING, BUT NOT LIMITED TO, DRILLS, SETTING TOOLS, CLEAN-OUT BRUSHES, BLOW OUT BULBS, OIL-FREE COMPRESSED AIR, SHOP VACUUMS, WRENCHES, ETC.
14. ANCHORS SHALL BE INSTALLED IN HOLES DRILLED WITH A ROTARY IMPACT HAMMER DRILL OR ROCK DRILL.
15. ANCHOR HOLES SHALL BE THOROUGHLY CLEANED PRIOR TO ADHESIVE INJECTION, AS REQUIRED BY THE MANUFACTURERS PRINTED INSTALLATION INSTRUCTIONS.
16. ANCHORS TO BE INSTALLED IN THE ADHESIVE SHALL BE CLEAN, OIL-FREE, AND FREE OF LOOSE RUST, PAINT, OR OTHER COATINGS.
17. INSTALLED ADHESIVE ANCHORS SHALL BE SECURELY FIXED IN-PLACE TO PREVENT DISPLACEMENT WHILE THE ADHESIVE CURES. UNLESS SHOWN OTHERWISE ON THE DRAWINGS, ANCHORS SHALL BE INSTALLED PERPENDICULAR TO THE CONCRETE SURFACE. ANCHORS DISPLACED BEFORE FULL ADHESIVE CURE SHALL BE CONSIDERED DAMAGED AND REPLACED AT THE CONTRACTOR'S EXPENSE.
18. REINFORCING BARS OR ALL-THREADED BARS SHALL NOT BE BENT AFTER BEING ADHESIVELY EMBEDDED IN HARDENED, SOUND CONCRETE, UNLESS PERMITTED BY THE ENGINEER.
19. WHERE INDICATED ON THE DRAWINGS, POST-INSTALLED ANCHORS SHALL CONSIST OF ONE OF THE FOLLOWING ANCHOR TYPES AS PROVIDED BY HILTI, INCORPORATED. CONTACT HILTI AT (800) 879-8000 FOR PRODUCT RELATED QUESTIONS. ANY PROPOSED SUBSTITUTIONS SHALL BE EQUAL IN CAPACITY TO THE NOTED ANCHORS (CONSIDERING ALL MODES OF FAILURE), SHALL MEET THE TESTING APPROVAL CRITERIA STIPULATED IN ICC-ES AC308/ICC-ES AC58, AND SHALL BE APPROVED, IN WRITING, BY THE ENGINEER OF RECORD PRIOR TO USE.
20. WHERE DRAWINGS INDICATE "ADHESIVE ANCHOR" (ADH ANCH) FOR ANCHORAGE TO EXISTING CONCRETE (CRACKED OR UNCRACKED):
    A. USE HILTI HIT-HY 200 SAFE SET SYSTEM PER ICC-ESR-3187.
    B. ANCHORS: USE HILTI HIT-Z ROD, CARBON STEEL UNLESS NOTED OTHERWISE. (USER NOTE: SAFESET APPLICABLE FOR HIT-Z RODS 3/8" ∅ TO 3/4"∅ ONLY - VERIFY SPECIFIED ANCHORS MEET DIAMETER LIMITATION)
    C. PROVIDE ANCHOR DIAMETER AND EMBEDMENT AS INDICATED ON RELATED SECTIONS/DETAILS. (USER NOTE: SAFESET APPLICABLE FOR HIT-Z RODS 3/8" ∅ TO 3/4"∅ ONLY - VERIFY SPECIFIED ANCHORS MEET DIAMETER LIMITATION)
    D. PROVIDE ANCHOR SPACING AND EDGE DISTANCE AS INDICATED ON RELATED SECTIONS/DETAILS. NOTE: NO ADHESIVE ANCHOR SHALL BE PLACED CLOSER THAN 3 INCHES FROM AN EDGE OF CONCRETE.
    E. PERMISSIBLE DRILLING METHOD PER MANUFACTURER. REFER TO MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
21. WHERE DRAWINGS INDICATE "ADHESIVE ANCHOR" (ADH ANCH) FOR ANCHORAGE TO SOLID GROUTED MASONRY:
    A. USE HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM PER ICC-ESR-2682.
    B. ANCHORS: USE HILTI HAS-E CONTINUOUSLY THREADED ROD (CARBON STEEL UNLESS NOTED OTHERWISE) OR CONTINUOUSLY DEFORMED STEEL REBAR.
    C. PROVIDE ANCHOR DIAMETER AND EMBEDMENT AS INDICATED ON RELATED SECTIONS/DETAILS. EMBEDMENT IS MEASURED FROM THE OUTSIDE FACE OF THE CONCRETE MASONRY UNIT.
    D. PROVIDE ANCHOR SPACING AND EDGE DISTANCE AS INDICATED ON RELATED SECTIONS/DETAILS. NOTE: NO ADHESIVE ANCHOR SHALL BE PLACED CLOSER THAN 4 INCHES FROM AN EDGE OF MASONRY.
    E. ANCHORS INTO THE FACE OF A MASONRY WALL MAY BE INSTALLED IN ANY LOCATION IN THE FACE OF MASONRY WALL, INCLUDING CELL, WEB, AND MORTAR JOINTS. ANCHORS ARE LIMITED TO ONE PER MASONRY CELL.
    F. ANCHORS INTO THE TOP OF A GROUT FILLED MASONRY WALL ARE NOT PERMITTED TO BE INSTALLED IN A HEAD JOINT, FLANGE, OR WEB AND ARE LIMITED TO ONE PER BLOCK.
    G. REFER TO MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
22. WHERE DRAWINGS INDICATE "ADHESIVE ANCHOR" (ADH ANCH) FOR ANCHORAGE TO HOLLOW CONCRETE MASONRY:
    A. USE HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM PER ICC ESR-3342 URM.
    B. ANCHORS: USE HILTI HAS-E CONTINUOUSLY THREADED ROD, CARBON STEEL UNLESS NOTED OTHERWISE.
    C. THE APPROPRIATE SIZE SCREEN TUBE SHALL BE USED PER ADHESIVE MANUFACTURER'S RECOMMENDATION.
    D. PROVIDE ANCHOR DIAMETER AS INDICATED ON RELATED SECTIONS/DETAILS. EMBEDMENT IS THE LENGTH OF THE APPROPRIATE HIT-SC SCREEN.
    E. PROVIDE ANCHOR SPACING AND EDGE DISTANCE AS INDICATED ON RELATED SECTIONS/DETAILS. NOTE: NO ADHESIVE ANCHOR SHALL BE PLACED CLOSER THAN 4 INCHES FROM THE EDGE OF HOLLOW CONCRETE MASONRY.
    F. ANCHORS INTO THE FACE OF AN UNGROUTED MASONRY WALL SHALL BE INSTALLED IN THE CELL ONLY. INSTALLATION IN OTHER LOCATIONS SUCH AS MORTAR JOINTS, FLANGES, OR WEBS, ARE NOT PERMITTED.
    G. REFER TO MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
    H. ADHESIVE ANCHORS TO HOLLOW CONCRETE MASONRY ARE NOT RECOGNIZED FOR RESISTING EARTHQUAKE FORCES.
23. WHERE DRAWINGS INDICATE "ADHESIVE ANCHOR" (ADH ANCH) FOR ANCHORAGE TO HOLLOW BRICK/MULTI-WYTHE MASONRY:
    A. USE HILTI HIT-HY 270 MASONRY ADHESIVE ANCHORING SYSTEM PER ICC ESR-3342 URM.
    B. ANCHORS: USE HILTI HAS-E CONTINUOUSLY THREADED ROD, CARBON STEEL UNLESS NOTED OTHERWISE.
    C. THE APPROPRIATE SIZE SCREEN TUBE SHALL BE USED PER ADHESIVE MANUFACTURER'S RECOMMENDATION.
    D. PROVIDE ANCHOR DIAMETER AS INDICATED ON RELATED SECTIONS/DETAILS. EMBEDMENT IS THE LENGTH OF THE APPROPRIATE HIT-SC SCREEN.
    E. PROVIDE ANCHOR SPACING AND EDGE DISTANCE AS INDICATED ON RELATED SECTIONS/DETAILS. NOTE: NO ADHESIVE ANCHOR SHALL BE PLACED CLOSER THAN 8 INCHES FROM THE EDGE OF HOLLOW BRICK.
    F. ANCHORS INTO THE FACE OF HOLLOW BRICK SHALL BE LIMITED TO ONE ANCHOR PER BRICK, IN ANY LOCATION INCLUDING HORIZONTAL OR HEAD MORTAR JOINTS. DO NOT SPACE ANY TWO ANCHORS CLOSER THAN 8 INCHES.
    G. REFER TO MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
    H. ADHESIVE ANCHORS TO HOLLOW BRICK ARE NOT RECOGNIZED FOR RESISTING EARTHQUAKE FORCES.
24. WHERE DRAWINGS INDICATE "EXPANSION ANCHOR" (EXP ANCH) FOR ANCHORAGE TO EXISTING CONCRETE (CRACKED OR UNCRACKED):
    A. USE HILTI TORQUE CONTROLLED EXPANSION ANCHOR SYSTEM SUITED FOR SEISMIC AND CRACKED CONCRETE APPLICATIONS.
    B. ANCHORS: USE HILTI KWIK BOLT TZ PER ICC-ESR-1917, CARBON STEEL UNLESS NOTED OTHERWISE.
    C. PROVIDE ANCHOR DIAMETER AND EMBEDMENT AS INDICATED ON RELATED SECTIONS/DETAILS.
    D. PROVIDE ANCHOR SPACING AND EDGE DISTANCE AS INDICATED ON RELATED SECTIONS/DETAILS. NOTE: NO EXPANSION ANCHOR SHALL BE PLACED CLOSER THAN 4 INCHES FROM AN EDGE OF CONCRETE UNLESS SPECIFICALLY DETAILED.
    E. REFER TO MANUFACTURER'S PUBLISHED INSTALLATION INSTRUCTIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.
25. ANCHOR CAPACITY USED IN DESIGN SHALL BE BASED ON THE TECHNICAL DATA PUBLISHED BY HILTI OR SUCH OTHER METHOD AS APPROVED BY THE STRUCTURAL ENGINEER OF RECORD. SUBSTITUTION REQUESTS FOR ALTERNATIVE PRODUCTS MUST BE APPROVED IN WRITING BY THE STRUCTURAL ENGINEER OF RECORD PRIOR TO USE. CONTRACTOR SHALL PROVIDE CALCULATIONS DEMONSTRATING THAT THE SUBSTITUTED PRODUCT IS CAPABLE OF ACHIEVING THE PERFORMANCE VALUES OF THE SPECIFIED PRODUCT. SUBSTITUTIONS WILL BE EVALUATED BY THEIR HAVING AN ICC ESR SHOWING COMPLIANCE WITH THE TESTING CRITERIA, INSTALLATION CATEGORY, AND AVAILABILITY OF COMPREHENSIVE RELEVANT BUILDING CODES FOR SEISMIC USES, LOAD RESISTANCE, INSTALLATION INSTRUCTIONS. ADHESIVE ANCHOR EVALUATIONS WILL ALSO CONSIDER CREEP, IN-SERVICE TEMPERATURE AND INSTALLATION TEMPERATURE.
26. INSTALL ANCHORS PER THE MANUFACTURER INSTRUCTIONS, AS INCLUDED IN THE ANCHOR PACKAGING.
27. THE CONTRACTOR SHALL ARRANGE AN ANCHOR MANUFACTURER'S REPRESENTATIVE TO PROVIDE ONSITE INSTALLATION TRAINING FOR ALL OF THEIR ANCHORING PRODUCTS SPECIFIED. THE STRUCTURAL ENGINEER OF RECORD MUST RECEIVE DOCUMENTED CONFIRMATION THAT ALL OF THE CONTRACTOR'S PERSONNEL WHO INSTALL ANCHORS ARE TRAINED PRIOR TO THE COMMENCEMENT OF INSTALLING ANCHORS.
28. ANCHOR CAPACITY IS DEPENDANT UPON SPACING BETWEEN ADJACENT ANCHORS AND PROXIMITY OF ANCHORS TO EDGE OF CONCRETE. INSTALL ANCHORS IN ACCORDANCE WITH SPACING AND EDGE CLEARANCES INDICATED ON THE DRAWINGS.
29. AN INDEPENDENT, APPROVED AGENCY SHALL PERFORM SPECIAL INSPECTION OF POST INSTALLED ANCHORS IN ACCORDANCE WITH REQUIREMENTS OF IBC, CHAPTER 17. REFER TO SPECIFICATION SECTION 01 41 00-TESTING LABORATORY SERVICES FOR SPECIAL INSPECTION REQUIREMENTS.

STRUCTURAL DRAWING LIST

SG.1 STRUCTURAL GENERAL NOTES AND DRAWING LIST
SG.2 STRUCTURAL DESIGN CRITERIA, ABBREVIATIONS, AND NOTES

S2.1.A HOME CLUBHOUSE FLOOR-FOUNDATION PLAN
S2.1.B VISITOR CLUBHOUSE FLOOR FOUNDATION PLAN
S2.1.C HOME BULLPEN FOUNDATION PLAN
S2.1.D VISITOR BULLPEN FOUNDATION PLAN
S2.1.E BATTING ARENA ADDITION FLOOR FOUNDATION PLAN
S2.2.A BATTING ARENA ADDITION CONCOURSE LEVEL FRAMING PLAN
S2.3.A BATTING ARENA ADDITION ROOF FRAMING PLAN
S2.3.B CLUBHOUSE EXISTING ROOF FRAMING PLAN

S3.1.1 FOUNDATION SECTIONS
S3.1.2 FOUNDATION SECTIONS
S3.2.1 SECTIONS

S4.1.1 COLUMN SCHEDULE AND DETAILS
S4.1.2 SCHEDULES

S5.1.1 TYPICAL DETAILS
S5.2.1 TYPICAL DETAILS

COLD FORMED METAL FRAMING NOTES

1. ALL COLD FORMED METAL FRAMING (CFMF) IS TO CONFORM TO ASTM A653, CQ, GRADE 33 AND HAVE A MINIMUM YIELD POINT OF 33,000 PSI. ALL CFMF TO BE HOT-DIP GALVANIZED FOR A MINIMUM G60 COATING.
2. ALL CFMF WILL CONFORM TO THE FOLLOWING CRITERIA:
   A. WALL STUDS AND JOISTS TO BE SPACED NO FURTHER APART THAN 16 INCHES ON CENTER.
   B. WALL STUDS AND JOISTS TO HAVE THE FOLLOWING SECTION PROPERTIES:
      - FLANGE WIDTH = 1-5/8 INCHES MINIMUM
      - GAGE = 16 MINIMUM
   C. WALL STUDS SHALL BE BRACED BY CONTINUOUS MECHANICAL BRIDGING TO FULLY DEVELOP BENDING CAPACITY OF THE STUDS.
   D. WALL STUD ENDS TO BE ATTACHED TO TRACK COMPONENTS AT THE TOP AND BOTTOM OF THE WALL ASSEMBLY.
3. INSTALLATION OF CFMF IS TO BE IN STRICT ACCORDANCE WITH AISI AND MANUFACTURER'S RECOMMENDATIONS.
4. PROVIDE A MINIMUM OF TWO STUDS AT THE EDGES OF ALL WALL OPENINGS.
5. MAKE CONNECTIONS OF ALL CFMF MEMBERS PRIOR TO INSTALLATION OF GYPSUM WALLBOARD.
6. TRACK RUNNER MATERIAL THICKNESS TO BE AT LEAST EQUAL TO THE TYPICAL WALL STUD MEMBER THICKNESS.
7. NO DEAD LOAD OR LIVE LOAD TO BE DIRECTLY IMPOSED ON WALL TRACK OR RUNNER UNLESS SPECIFICALLY DESIGNED.
8. ALL LIGHT GAUGE STEEL MULTIPLE STUD MEMBERS TO BE CONNECTED AT 16" O.C. AT EACH FACE OF THE STUD FLANGE.
9. FRAMING MEMBERS INSTALLED ALIGN AND PLUMB.
10. SPLICES IN FRAMING MEMBERS NOT PERMITTED UNLESS SPECIFIED.
11. BOTH FLANGES OF STUDS SHALL BE CONNECTED TO THE TOP AND BOTTOM TRACK.
12. ALL WELDS AND OTHER CONNECTIONS ARE TO BE TOUCHED UP USING GALVANIZING PAINT (SEE SPECIFICATIONS).
13. FOR ADDITIONAL REQUIREMENTS SEE THE PROJECT'S PLANS AND THE SPECIFICATIONS.

MASONRY WALL NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR NON-BEARING CMU WALLS AND ADD'L MASONRY DETAILS. FOR ADDITIONAL REQUIREMENTS SEE TYPICAL DETAILS AND MASONRY SPECIFICATIONS. ALL INTERIOR WALLS NOT INDICATED ON STRUCTURAL PLANS SHALL BEAR ON THICKENED SLAB FOUNDATIONS IN ACCORDANCE WITH TYPICAL DETAILS IN S5.1.
2. ALL MASONRY WALLS SHALL BE REINFORCED AS INDICATED ON THE DRAWINGS. DOWEL ALL MASONRY WALLS TO CONCRETE SLABS, UNLESS NOTED OTHERWISE. SEE TYPICAL DETAILS FOR ADDITIONAL REQUIREMENTS AT WALL CORNERS AND INTERSECTIONS. DOWEL SIZE AND SPACING TO MATCH VERTICAL WALL REINFORCING. BUILDING CORNERS ARE DEFINED AS 10 PERCENT OF LEAST HORIZONTAL DIMENSION OR 0.4H (H=MEAN ROOF HEIGHT), WHICHEVER IS SMALLER, BUT NOT LESS THAN 4 PERCENT OF LEAST HORIZONTAL DIMENSION OR 3 FEET.
3. MASONRY WALL REINFORCING BARS SHALL BE ASTM A615 GRADE 60 IN GROUTED CELLS. MASONRY WALL DOWELS / REINFORCING BARS WELDED TO STRUCTURAL STEEL SHALL BE ASTM A706 GRADE 60.
4. ALL MASONRY WALLS SHALL BE SOLID GROUTED BELOW GRADE.
5. HORIZONTAL JOINT REINFORCEMENT SHALL BE FACTORY FABRICATED FROM STEEL WIRE CONFORMING TO ASTM A 82, WELDED CONSTRUCTION. WIRE SHALL HAVE ZINC COATING CONFORMING TO ASTM A 153, CLASS B-2. ALL WIRES SHALL BE A MINIMUM OF 9 GAUGE. REINFORCEMENT SHALL BE LADDER TYPE DESIGN, HAVING ONE LONGITUDINAL WIRE IN THE MORTAR BED OF EACH FACE SHELL FOR HOLLOW UNITS AND ONE WIRE FOR SOLID UNITS. JOINT REINFORCEMENT SHALL BE SPACED VERTICALLY AT 16 INCHES ON CENTER OR AS INDICATED. REINFORCEMENT SHALL BE LAPPED NOT LESS THAN 6 INCHES. LAP SPLICE VERTICAL REINFORCING BARS 48 TIMES THE DIAMETER OF THE BAR. HORIZONTAL REINFORCING SHALL BE CONTINUOUS AT CORNERS AND INTERSECTIONS. JOINT REINFORCEMENT SHALL BE PROVIDED WITH FACTORY FORMED CORNERS AND INTERSECTIONS.
6. WELD GALVANIZED TIES CONFORMING TO ASTM A 82, CLASS B2 ANCHORS TO STEEL COLUMN AND BEAM FLANGES AND WEB. SPACE 16-INCHES ON CENTER MAX.
7. ALL CONCRETE MASONRY UNITS SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 1900 PSI WITH TYPE S MORTAR. (f 'm = 1500 PSI)
8. PROVIDE TEMPORARY BRACING FOR MASONRY WALLS DURING ENTIRE ERECTION OF WALLS AND UNTIL THE MORTAR HAS DEVELOPED ADEQUATE STRENGTH. TEMPORARY BRACES SHALL NOT BE REMOVED UNTIL AT LEAST 7 DAYS HAVE ELAPSED SINCE THE WALL WAS COMPLETELY ERECTED.
9. REINFORCE BOND BEAMS AS INDICATED. PROVIDE CONTINUOUS BOND BEAMS AT THE FOLLOWING LOCATIONS:
   - WHERE INDICATED IN SECTIONS AND DETAILS ON THE DRAWINGS
   - AT THE TOP OF ALL MASONRY WALLS (WITHIN TOP 2 COURSES)
   - AT THE TOP OF PARAPETS
10. FILL MASONRY WALL CORES CONTAINING REINFORCING WITH FINE GROUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AT 28 DAYS.
11. SEE SHEET S4.1.2 FOR LINTEL SCHEDULE AND DETAILS..

UNISTRUT NOTES

1. RETAIN A REGISTERED PROFESSIONAL ENGINEER, LICENSED IN THE STATE OF MARYLAND WHO SHALL DESIGN ALL THE UNISTRUT AND THEIR CONNECTIONS TO MEET THE REQUIREMENTS OF THE INTENT SHOWN ON THESE DRAWINGS. THE SHOP DRAWINGS SHALL BEAR THE SEAL AND SIGNATURE OF THE ENGINEER. ALL CALCULATIONS SHALL BE SUBMITTED TO THE OWNER AND THE ARCHITECT FOR RECORD ONLY.
2. UNISTRUT SIZES SHOWN ARE FOR PRICING ONLY. UNISTRUT ENGINEER TO VERIFY SIZES SHOWN AND LAYOUT TO MEET THE DESIGN REQUIREMENTS OF GE EQUIPMENT.
3. COORDINATE WITH EQUIPMENT DRAWINGS SPECIFIC TOLERANCES AND REQUIREMENTS WHICH THE UNISTRUT SYSTEM MUST MEET FOR THE PROPER FUNCIONALITY OF THE SUPPORTED EQUIPMENT.
4. SUBMIT SHOP DRAWINGS TO THE ARCHITECT AND EQUIPMENT MANUFACTURER FOR REVIEW. DO NOT START ANY FABRICATION UNTIL SHOP DRAWINGS ARE REVIEWED BY THE ARCHITECT AND THE EQUIPMENT MANUFACTURER.
5. SIZES ARE BASED ON UNISTRUT SYSTEM. ALTERNATE SUPPORT SYSTEMS MAY BE SUBMITTED FOR APPROVAL BY THE ARCHITECT BUT THE SYSTEM MUST BE ENGINEERED BY A REGISTERED PROFESSIONAL ENGINEER, LICENSED IN THE STATE OF THE PROJECT.
6. ALL CONNECTIONS SHALL BE MADE USING A MIN. OF 1/2-INCH DIAMETER BOLTS AND SPRING NUTS.

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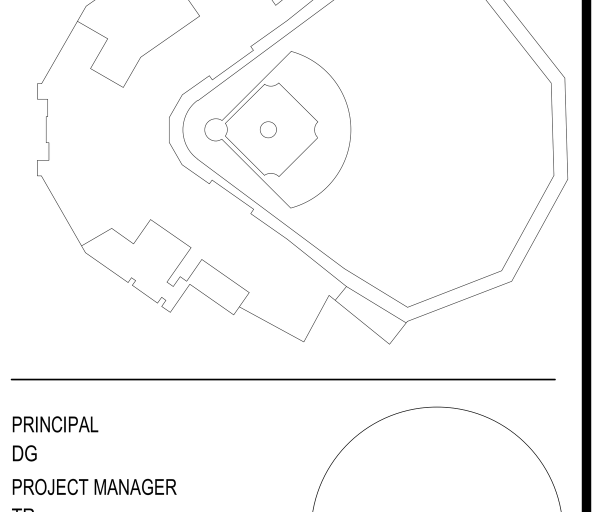
KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
C	EC	ISSUE 3: STEEL	6/4/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 12" = 1'-0"
DRAWING NAME
STRUCTURAL GENERAL NOTES AND DRAWING LIST

PHASE CD
DRAWING NO. SG.1

6/21/2024 1:08:14 PM C:\Revit Local Files\20230573_S24_CENTRAL_rjgonzalezY2N9Y.rvt

ABBREVIATIONS

AB	ANCHOR BOLT	HK	HOOK
ACI	AMERICAN CONCRETE INSTITUTE	HORIZ	HORIZONTAL
		HP	HIGH POINT
ADJMT	ADJUSTMENT	IE	INVERT ELEVATION
ADDL	ADDITIONAL	I.F.	INSIDE FACE
ANCH	ANCHOR	INCL	INCLUSIVE
ARCH	ARCHITECTURAL	INFO	INFORMATION
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	JST	JOIST
		JT	JOINT
BLDG	BUILDING	K	KIPS (1000 LB.)
BLKG	BLOCKING	KSF	KIPS PER SQUARE FOOT
BM	BEAM	KSI	KIPS PER SQUARE INCH
BOT	BOTTOM	LOC	LOCATION
BPL	BASEPLATE	LL	LIVE LOAD
BRCG	BRACING	LLH	LONG LEG HORIZONTAL
BRG	BEARING	LLV	LONG LEG VERTICAL
BRK	BRICK	LP	LOW POINT
BRKT	BRACKET	LWT	LIGHT WEIGHT
BS	BOTH SIDE (USED W/ REINF)	MAS	MASONRY
BS	BRICK SHELF	MAX	MAXIMUM
BSMT	BASEMENT	MECH	MECHANICAL
BTWN	BETWEEN	MTL	METAL
CANT	CANTILEVER	MFR	MANUFACTURER
CB	CONCRETE BEAM	MIN	MINIMUM
CFMF	COLD FORMED METAL FRAMING	(N)	NEW STRUCTURAL
CJ	CONTROL JOINT	NA	NEUTRAL AXIS
CL	CENTERLINE	NO	NUMBER
CLR	CLEAR	NS	NEAR SIDE
CM	CONSTRUCTION MANAGER	N-S	NORTH-SOUTH
CMU	CONCRETE MASONRY UNIT	OC	ON CENTER
COL	COLUMN	O.F.	OUTSIDE FACE
COMP	COMPRESSIBLE	OPNG	OPENING
CONC	CONCRETE	OPP HD	OPPOSITE HAND
CONN	CONNECTION	ORIENT	ORIENTATION
CONST	CONSTRUCTION	PC	PRECAST
CONT	CONTINUOUS	P.C.	PRECAST CONCRETE
CONTR	CONTRACTOR	PCF	POUNDS PER CUBIC FOOT
COORD	COORDINATE	PED	PEDESTAL
CR	CRIPPLED	PENET	PENETRATION
(D)	STRUCTURE TO BE DEMOLISHED	PL	PLATE
DBL	DOUBLE	PLUMB	PLUMBING
DET	DETAIL	PW	PLYWOOD
DEV	DEVELOPMENT	PNL	PANEL
DIAG	DIAGONAL	PREM	PREMOLDED
DIST	DISTANCE	PSI	POUNDS PER SQUARE INCH
DK	DECK	PSF	POUNDS PER SQUARE FOOT
DL	DEAD LOAD	REINF	REINFORCING
DN	DOWN	REQD	REQUIRED
DWG	DRAWING	RET	RETAINING
DWL	DOWEL	REV	REVISION
EA	EACH	RF	ROOF
EF	EACH FACE	RO	ROUGH OPENING
EL	ELEVATION	SCHED	SCHEDULE
ELEC	ELECTRICAL	SD	SUPERIMPOSED DEAD LOAD
ELEV	ELEVATOR	SECT	SECTION
EMB	EMBEDMENT	SPAN.	SPANDREL
EQ	EQUAL	SPEC	SPECIFICATIONS
ETC	ETCETERA	STAGG	STAGGERED
EW	EACH WAY	STD	STANDARD
E-W	EAST-WEST	STIFF.	STIFFENER
EXIST, (E)	EXISTING	STL.	STEEL
EXP	EXPANSION	SUPP	SUPPORT
EXP JT	EXPANSION JOINT	T&B	TOP AND BOTTOM
FDN	FOUNDATION	TEMP	TEMPORARY
FIN	FINISH	THK	THICK, THICKNESS
FLG	FLANGE	TOC.	TOP OF CONCRETE
FLR	FLOOR	TOL	TOLERANCE
FRMG	FRAMING	TOP	TOP OF PEDESTAL
FS	FAR SIDE	TOS	TOP OF STEEL
FTG	FOOTING	TOW	TOP OF WALL
GA	GAGE	TYP	TYPICAL
GALV	GALVANIZED	UNO	UNLESS NOTED OTHERWISE
GB	GRADE BEAM	V	VERTICAL (USED W/ REINF.)
GC	GENERAL CONTRACTOR	VERT	VERTICAL
GRAN	GRANULAR	VIF	VERIFY IN FIELD
GR BM	GRADE BEAM	WD	WOOD
H	HORIZONTAL (USED W/ REINF.)	WP	WORK POINT
		WS	WATER STOP
		WWF	WELDED WIRE FABRIC

DESIGN CRITERIA *IBC 2015*

FLOOR AND ROOF DESIGN LOADS

FLOOR DESIGN LIVE LOADS:	
BATTING ARENA FLOOR	100 PSF
CLUBHOUSE WEIGHT ROOM	150 PSF
CLUBHOUSE FLOOR	100 PSF
ROOF DESIGN LIVE LOADS:	
BATTING ARENA ROOF	30 PSF
RAIN LOAD DATA:	
RAIN INTENSITY	i=3.52 IN/HR
SNOW LOAD DATA:	
GROUND SNOW LOAD	P_g=20 PSF
SNOW EXPOSURE FACTOR	C_e=1.0
SNOW LOAD IMPORTANCE FACTOR	I_s=1.1
THERMAL FACTOR	C_t=1.0
FLAT ROOF SNOW LOAD	P_f=30 PSF
MAXIMUM DRIFT SURCHARGE LOAD	P_d=48 PSF
MAXIMUM WIDTH OF SNOW DRIFT	w=11'-6"

LATERAL LOADS - WIND

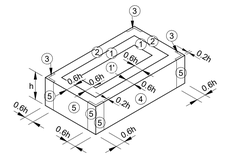
WIND LOAD DESIGN PARAMETERS:

BASIC DESIGN WIND SPEED	V=129 MPH
ALLOWABLE STRESS DESIGN WIND SPEED	V_{asd}=100 MPH
WIND EXPOSURE	C
INTERNAL PRESSURE COEFFICIENT	GC_{pi}=±0.18

WIND LOADS ON COMPONENTS AND CLADDING:

COMPONENT LOCATION **		
ZONE 1'	TYPICAL ROOF	-24.0 PSF
ZONE 1	ROOF PERIMETER 1	-42.0 PSF
ZONE 2	ROOF PERIMETER 2	-55.0 PSF
ZONE 3	ROOF CORNER	-55.0 PSF
ZONE 4	TYPICAL WALL	-26.0 PSF
ZONE 5	WALL CORNERS	-32.0 PSF

** NOTE: COMPONENT WIND LOADS ARE BASED ON A TRIBUTARY AREA OF 10 SQ. FT. VALUES MAY BE ADJUSTED PROVIDED WIND LOAD CALCULATIONS ARE SUBMITTED FOR REVIEW. VALUES INDICATED ABOVE ARE NOMINAL PRESSURE(ASD VALUES).



LATERAL LOADS - SEISMIC

EARTHQUAKE DESIGN DATA

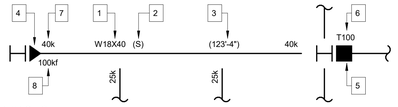
RISK CATEGORY	III
SEISMIC IMPORTANCE FACTOR	I_e=1.25
MAPPED SPECTRAL RESPONSE ACCELERATION AT SHORT PERIODS	S_S=0.092
MAPPED SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD	S_1=0.044
SOIL SITE CLASSIFICATION (FOR SEISMIC)	D
DESIGN SPECTRAL RESPONSE ACCELERATION AT SHORT PERIODS	S_{DS}=0.098
DESIGN SPECTRAL RESPONSE ACCELERATION AT 1-SECOND PERIOD	S_{D1}=0.071
SEISMIC DESIGN CATEGORY	B
BASIC SEISMIC FORCE-RESISTING SYSTEM	STEEL ORDINARY MOMENT FRAMES
SEISMIC RESPONSE COEFFICIENT	C_s=0.041
DESIGN BASE SHEAR	47 KIPS
RESPONSE MODIFICATION COEFFICIENT	R=3.0*
ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE

**** STRUCTURAL STEEL SYSTEM NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE IN ACCORDANCE WITH AISC 341 OR AISI LATERAL***

SOIL AND GEOTECHNICAL INFORMATION

ALLOWABLE BEARING PRESSURE	SEE SG.1 FOUNDATION NOTES
FROST PENETRATION DEPTH	30 INCHES

STRUCTURAL STEEL FRAMING KEY



KEY NOTES:

1. STEEL BEAM SIZE.
2. MEMBER IS SLOPED.
3. TOP OF STEEL ELEVATION ABOVE DATUM ELEVATION 0'-0" (BOTTOM OF ROOF DECK ELEVATION FOR ROOF FRAMING).
4. MOMENT CONNECTION. SEE 1/SS.2.1 FOR MOMENT CONNECTION DETAILS.
5. INDICATES DRAG STRUT.
6. DRAG CONNECTION CAPACITY (KIPS).
7. FACTORED REACTION (KIPS). SEE NOTES IN DETAIL 1/SS.2.1 FOR SPECIFIC MINIMUM CONNECTION REQUIREMENTS.
8. REQUIRED FACTORED MOMENT CAPACITY (KIP-FT). SEE 1/SS.2.1.

STRUCTURAL PLANS SYMBOL LEGEND

ES1	DENOTES EXISTING 5± INCH CONCRETE SLAB ON GRADE.
ES2	DENOTES EXISTING 11± INCH STRUCTURAL TWO-WAY CONCRETE SLAB.
ES6	DENOTES EXISTING 8"± SLOPED PLANK SLAB.
ES7	DENOTES SPAN OF EXISTING 1-1/2 INCH METAL ROOF DECK
S1	DENOTES 5-INCH CONCRETE SLAB ON GRADE REINFORCED WITH 6x6xW2.9xW2.9 W.W.F. SEE 1/SS.1.1.
D1	DENOTES SPAN OF 1-1/2 INCH BY 20-GAUGE TYPE 'B' GALVANIZED METAL ROOF DECK (MAXIMUM SPAN = 6'-6").
	DENOTES MOMENT CONNECTIONS AT ALL BEAM TO COLUMN JOINTS. SEE TYPICAL DETAIL 1/SS.2.1.
	DENOTES NEW CONCRETE WALL / SLAB / FOUNDATION.
	DENOTES NEW CMU WALL.
	EXISTING WALL
	EXISTING CONCRETE SLAB
	FLAT ROOF AREA
	SLAB OR FLOOR STEP
	UNDER SLAB PIPING/UTILITIES
	OPENING IN ROOF, SEE 4/SS.2.1
L#	LINTELS IN WALL OPNGS, SEE S4.1.2 FOR SCEHDULE
(HI) / (LO)	HIGH OR LOW MEMBER
	X-BRACING DESIGNATION, SEE DETAIL 8/SS.2.1

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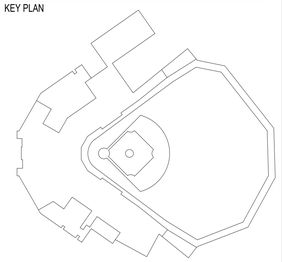

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C	EC	ISSUE 3: STEEL	6/4/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 12" = 1'-0"

DRAWING NAME

STRUCTURAL DESIGN CRITERIA, ABBREVIATIONS, AND NOTES

PHASE DRAWING NO.

CD SG.2

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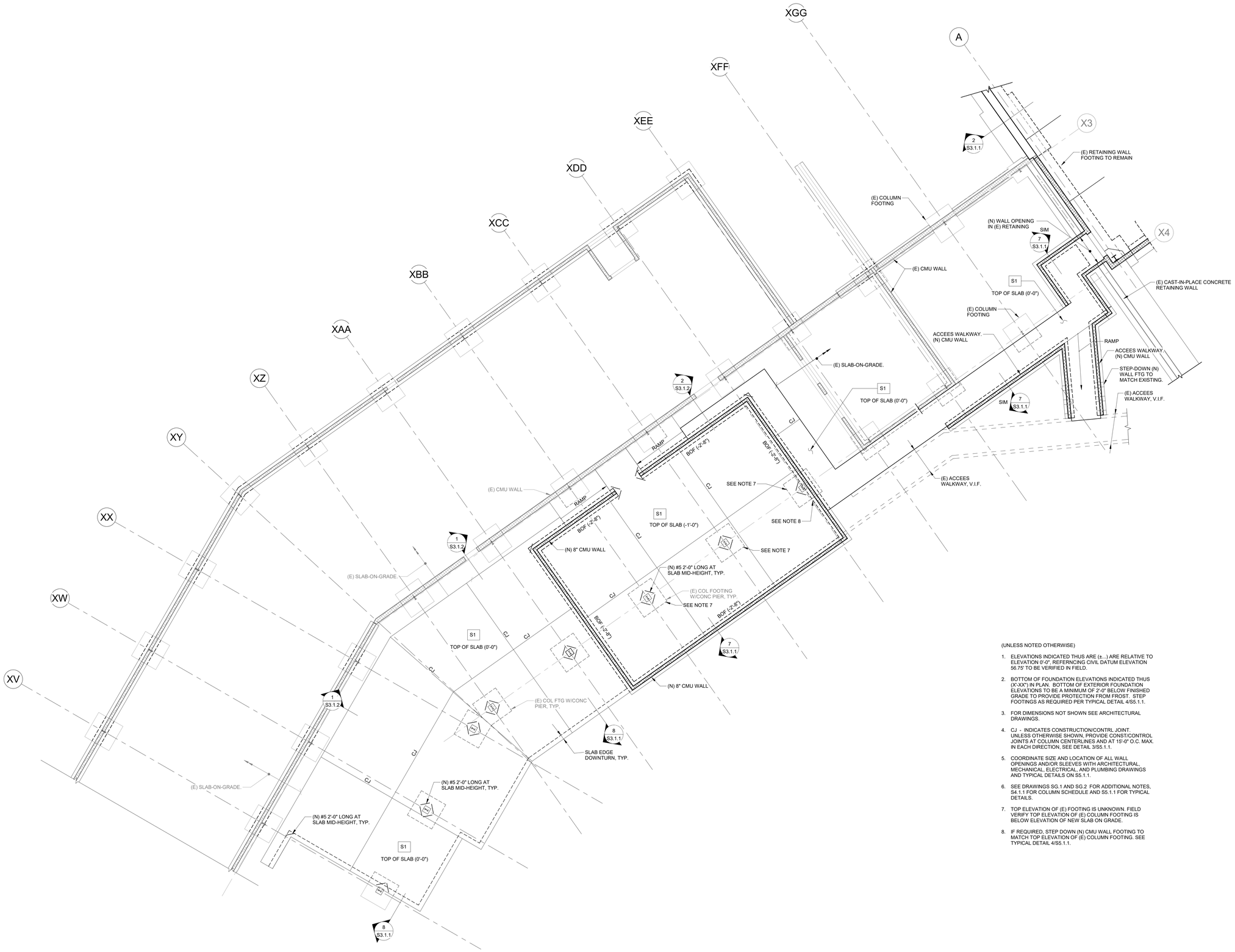

1 CLUBHOUSE FLOOR-FOUNDATION PLAN
SCALE: 1/8" = 1'-0"

(UNLESS NOTED OTHERWISE)

1. ELEVATIONS INDICATED THUS ARE (±...) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
2. BOTTOM OF FOUNDATION ELEVATIONS INDICATED THUS (X'-XX") IN PLAN. BOTTOM OF EXTERIOR FOUNDATION ELEVATIONS TO BE A MINIMUM OF 2'-0" BELOW FINISHED GRADE TO PROVIDE PROTECTION FROM FROST. STEP FOOTINGS AS REQUIRED PER TYPICAL DETAIL 4/S5.1.1.
3. FOR DIMENSIONS NOT SHOWN SEE ARCHITECTURAL DRAWINGS.
4. CJ - INDICATES CONSTRUCTION/CONTRL JOINT. UNLESS OTHERWISE SHOWN, PROVIDE CONST/CONTROL JOINTS AT COLUMN CENTERLINES AND AT 15'-0" O.C. MAX. IN EACH DIRECTION, SEE DETAIL 3/S5.1.1.
5. COORDINATE SIZE AND LOCATION OF ALL WALL OPENINGS AND/OR SLEEVES WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS AND TYPICAL DETAILS ON S5.1.1.
6. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.1.1 FOR TYPICAL DETAILS.
7. TOP ELEVATION OF (E) FOOTING IS UNKNOWN. FIELD VERIFY TOP ELEVATION OF (E) COLUMN FOOTING IS BELOW ELEVATION OF NEW SLAB ON GRADE.
8. IF REQUIRED, STEP DOWN (N) CMU WALL FOOTING TO MATCH TOP ELEVATION OF (E) COLUMN FOOTING. SEE TYPICAL DETAIL 4/S5.1.1.

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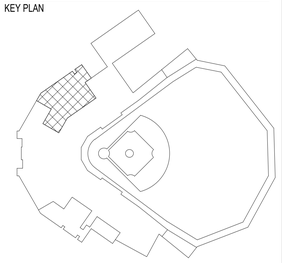

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PROJECT NO. 20230573 SCALE As indicated
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HOME CLUBHOUSE FLOOR-FOUNDATION PLAN

PHASE CD
DRAWING NO. S2.1.A

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1 CLUBHOUSE -S2-VISITOR FLOOR
SCALE: 1/8" = 1'-0"

(UNLESS NOTED OTHERWISE)

1. ELEVATIONS INDICATED THUS ARE (±...) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
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3. FOR DIMENSIONS NOT SHOWN SEE ARCHITECTURAL DRAWINGS.
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5. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.1.1 FOR TYPICAL DETAILS.

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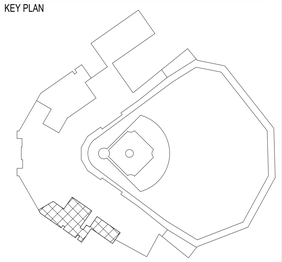

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VISITOR CLUBHOUSE FLOOR FOUNDATION PLAN

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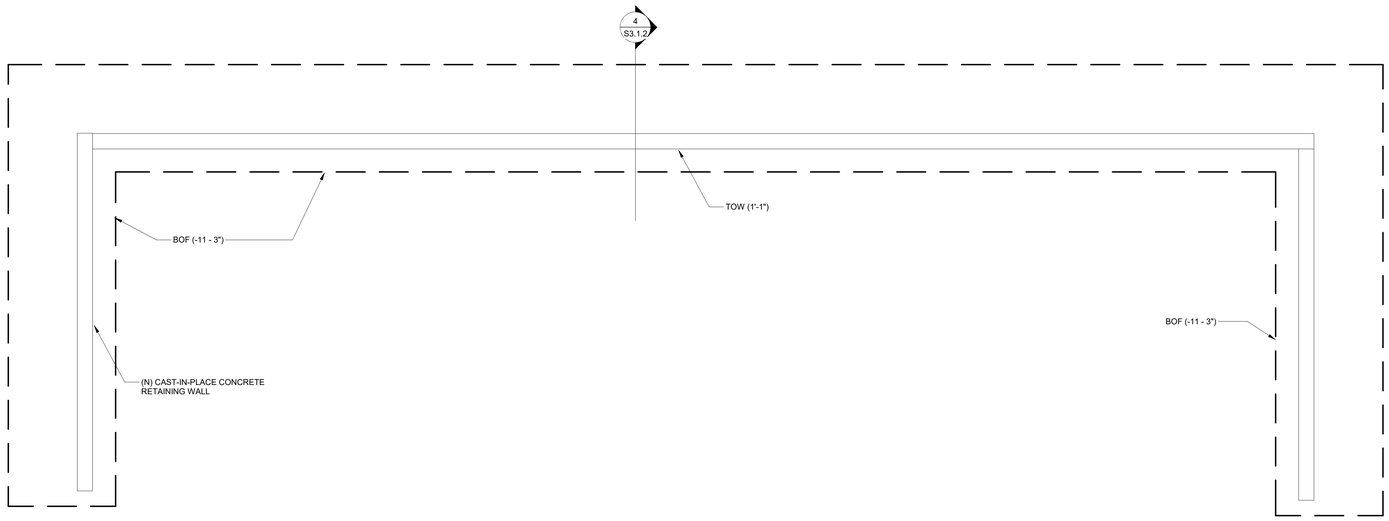

1 HOME BULLPEN FOUNDATION PLAN
SCALE: 1/4" = 1'-0"

(UNLESS NOTED OTHERWISE)

1. ELEVATIONS INDICATED THUS ARE (±...) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
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3. FOR DIMENSIONS NOT SHOWN SEE ARCHITECTURAL DRAWINGS.
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5. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.1.1 FOR TYPICAL DETAILS.

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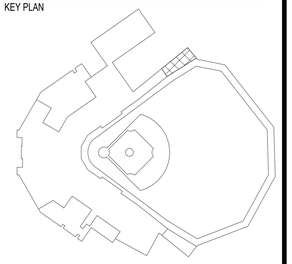

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HOME BULLPEN FOUNDATION PLAN

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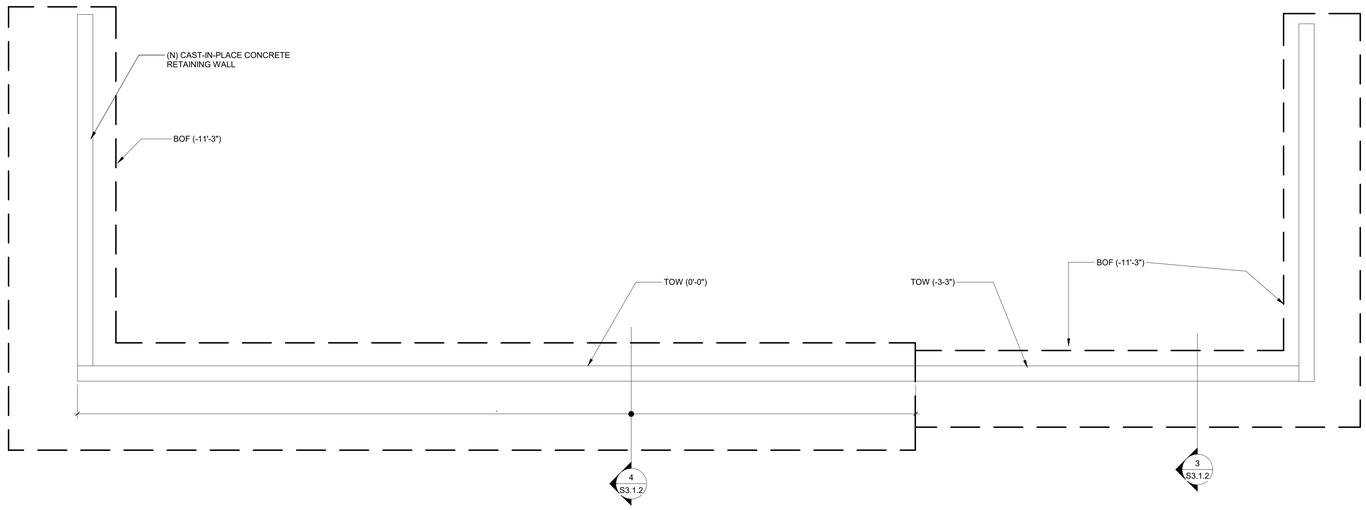

1 VISITOR BULLPEN FOUNDATION PLAN
SCALE: 1/4" = 1'-0"

(UNLESS NOTED OTHERWISE)

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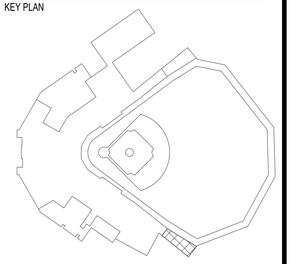

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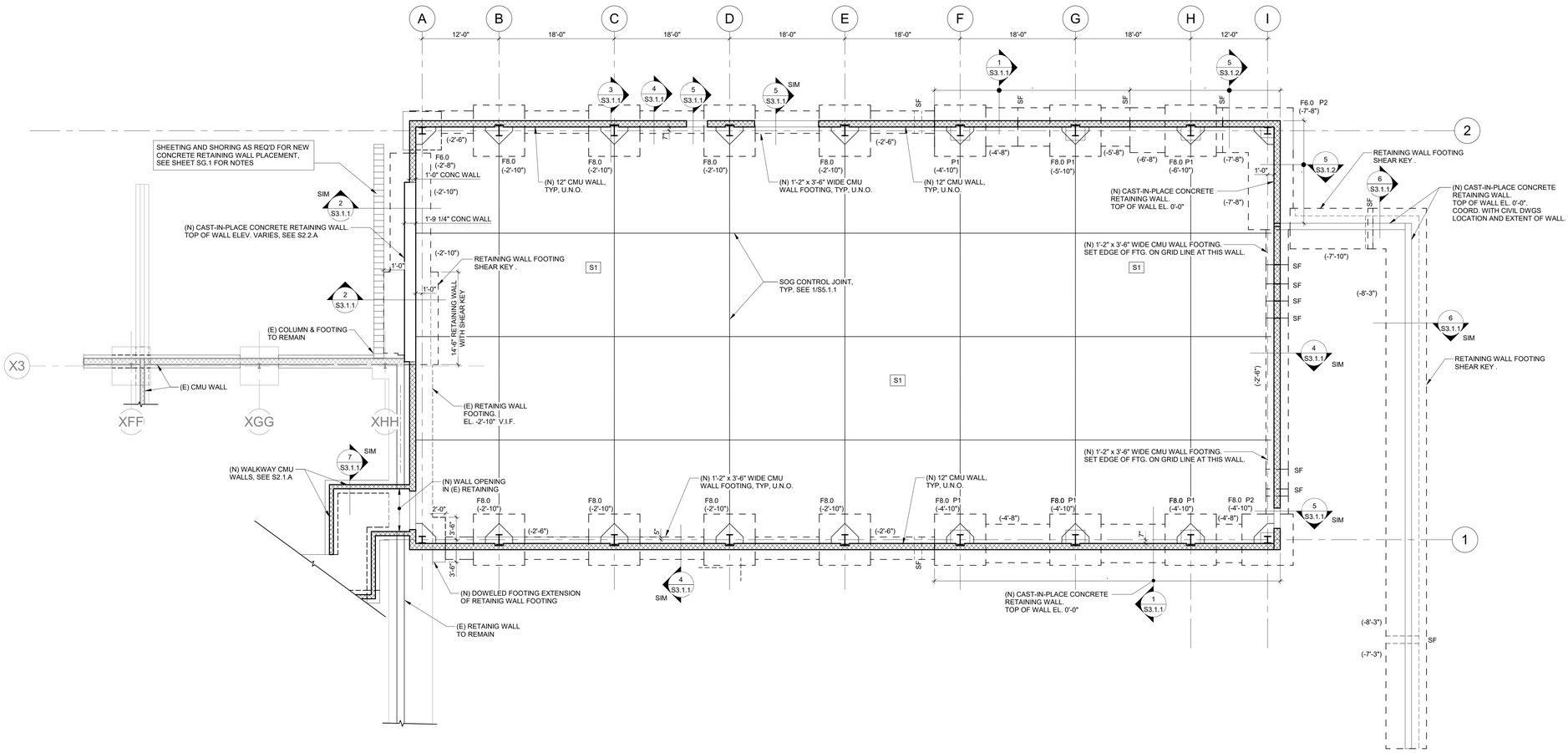

1 BATTING AREA FOUNDATION PLAN

SCALE: 1/8" = 1'-0"

(UNLESS NOTED OTHERWISE)

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6. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.1.1 FOR TYPICAL DETAILS.

FOOTING SCHEDULE

MARK	WIDTH	LENGTH	THICKNESS	REINFORCEMENT				REMARKS
				BOT REINF		TOP REINF		
				LONGER DIR	SHORTER DIR	LONGER DIR	SHORTER DIR	
F6.0	6'-0"	6'-0"	1'-4"	6-#5	6-#5			
F8.0	8'-0"	8'-0"	1'-6"	8-#6	8-#6	8-#6	8-#6	

CONCRETE PIER SCHEDULE

TYPE	SIZE	VERTICAL REINF.	TIES
P1	36"x36"	16-#8	#4 TIES @ 10" O.C.
P2	26"x26"	8-#7	#4 TIES @ 10" O.C.

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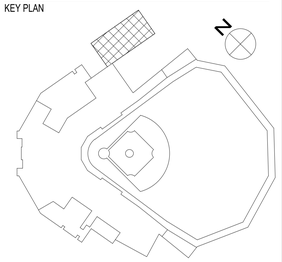

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REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

BATTING ARENA ADDITION FLOOR FOUNDATION PLAN

PHASE CD

DRAWING NO. S2.1.E

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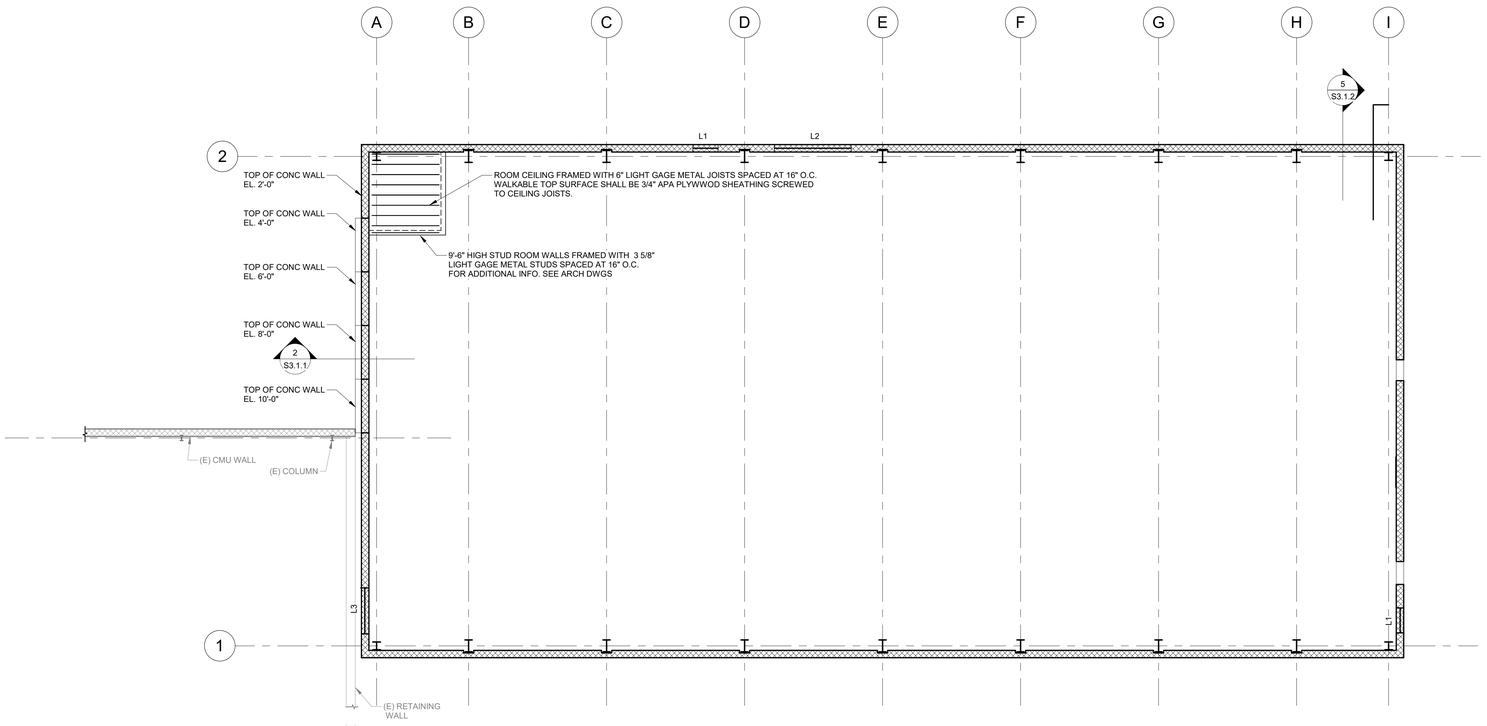

1 BATTING ARENA ADDITION CONCOURSE LEVEL FRAMING PLAN
SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. L(NO) - INDICATES LINTEL DESIGNATION, SEE SHEET S4.1.2 FOR SCHEDULE AND DETAILS,
2. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.1 FOR TYPICAL DETAILS.

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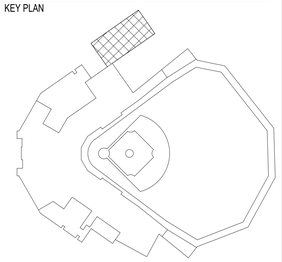

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PROJECT NO. 20230573 SCALE As indicated
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BATTING ARENA ADDITION CONCOURSE LEVEL FRAMING PLAN

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DRAWING NO.
S2.2.A

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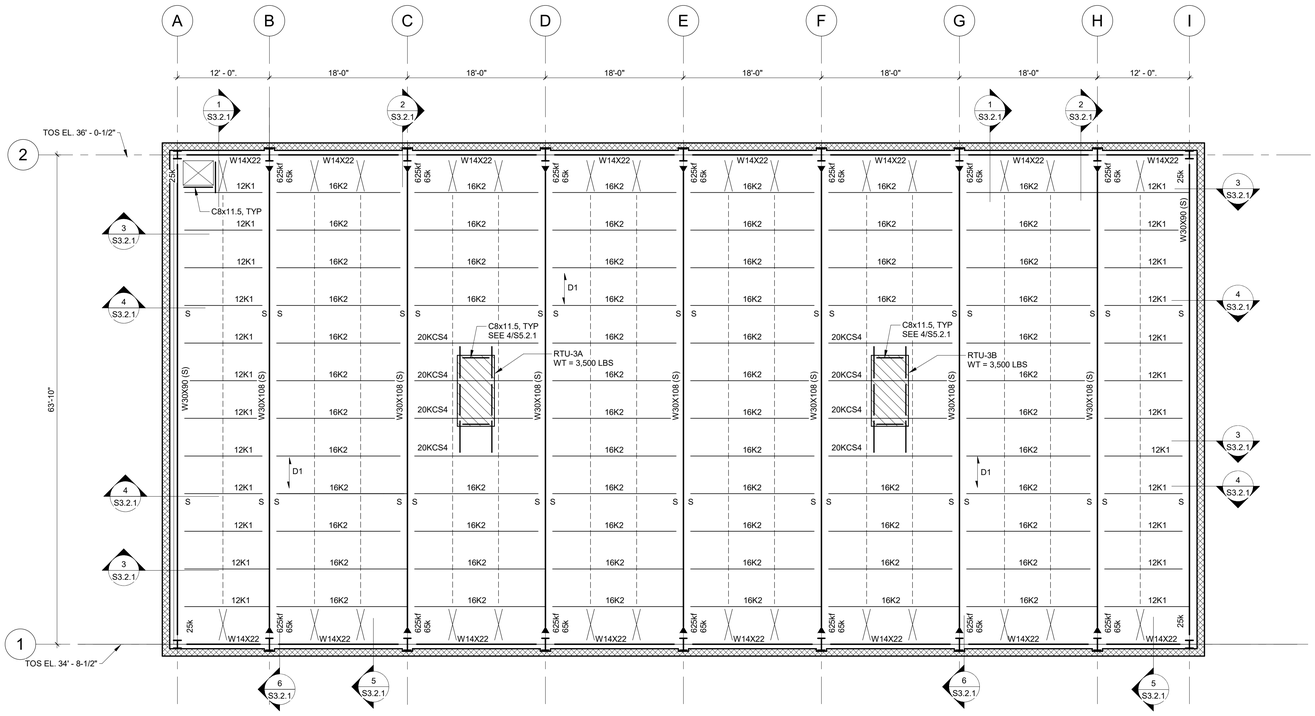

1 BATTING TUNNEL ADDITION ROOF FRAMING PLAN
SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. TOP OF STEEL ELEVATION INDICATED AS XX'-XX". ELEVATIONS INDICATED THUS (±) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
2. JOISTS ARE EQUALLY SPACED IN COLUMN BAYS UNLESS NOTED OTHERWISE.
3. S - INDICATES STRUT LOCATION, SEE SECTION 4/S3.2.1 FOR ADDITIONAL INFORMATION.
4. COORDINATE SIZE AND LOCATION OF ALL OPENINGS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS AND TYPICAL DETAILS.
5. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.2.1 FOR TYPICAL DETAILS.
6. SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS NOT INDICATED.

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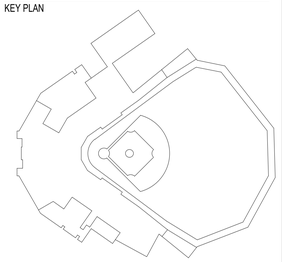
KEY PLAN



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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

BATTING ARENA ADDITION ROOF FRAMING PLAN

PHASE
CD

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S2.3.A

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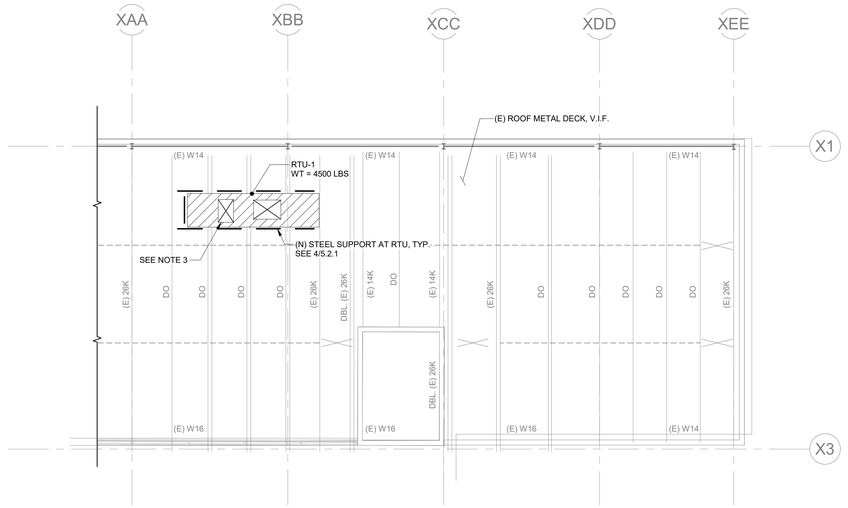
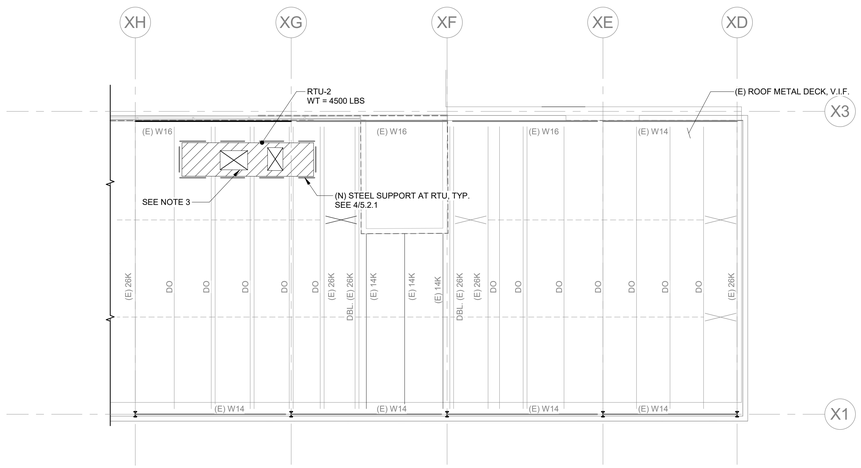


1 HOME CLUBHOUSE EXISTING ROOF FRAMING PLAN
SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. TOP OF STEEL ELEVATION INDICATED AS XX'-XX". ELEVATIONS INDICATED THUS (±) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
2. JOISTS ARE EQUALLY SPACED IN COLUMN BAYS UNLESS NOTED OTHERWISE.
3. NEW ROOF OPENING, SEE 4/S5.2.1 FOR FRAMING DETAILS.
4. COORDINATE SIZE AND LOCATION OF ALL OPENINGS WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS AND TYPICAL DETAILS.
5. SEE DRAWINGS SG.1 AND SG.2 FOR ADDITIONAL NOTES, S4.1.1 FOR COLUMN SCHEDULE AND S5.2.1 FOR TYPICAL DETAILS.
6. SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS NOT INDICATED.
7. (E) - INDICATES EXISTING.
8. (N) - INDICATES NEW.



2 VISITOR CLUBHOUSE EXISTING ROOF FRAMING PLAN
SCALE: 1/8" = 1'-0"

PLAN NOTES:

1. TOP OF STEEL ELEVATION INDICATED AS XX'-XX". ELEVATIONS INDICATED THUS (±) ARE RELATIVE TO ELEVATION 0'-0", REFERNCING CIVIL DATUM ELEVATION 56.75' TO BE VERIFIED IN FIELD.
2. JOISTS ARE EQUALLY SPACED IN COLUMN BAYS UNLESS NOTED OTHERWISE.
3. NEW ROOF OPENING, SEE 4/S5.2.1 FOR FRAMING DETAILS.
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7. (E) - INDICATES EXISTING.
8. (N) - INDICATES NEW.

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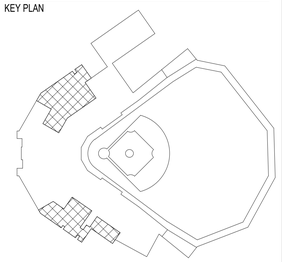
KEY PLAN



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ARTHUR PERDUE STADIUM IMPROVEMENTS

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CLUBHOUSE EXISTING ROOF FRAMING PLAN

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S2.3.B

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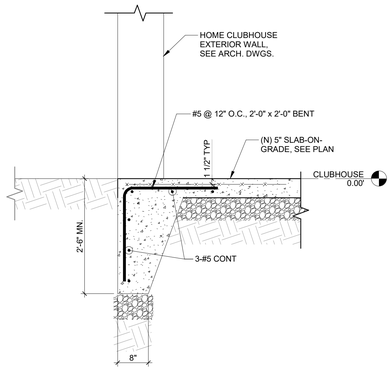
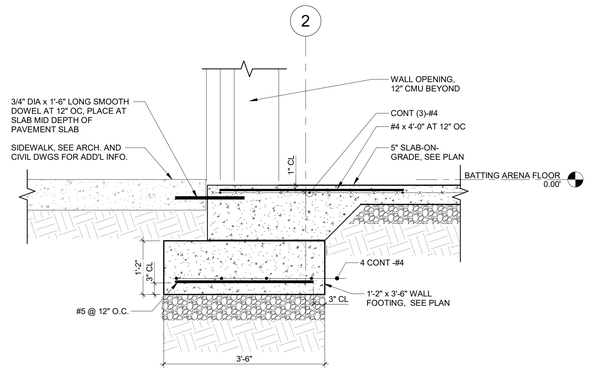
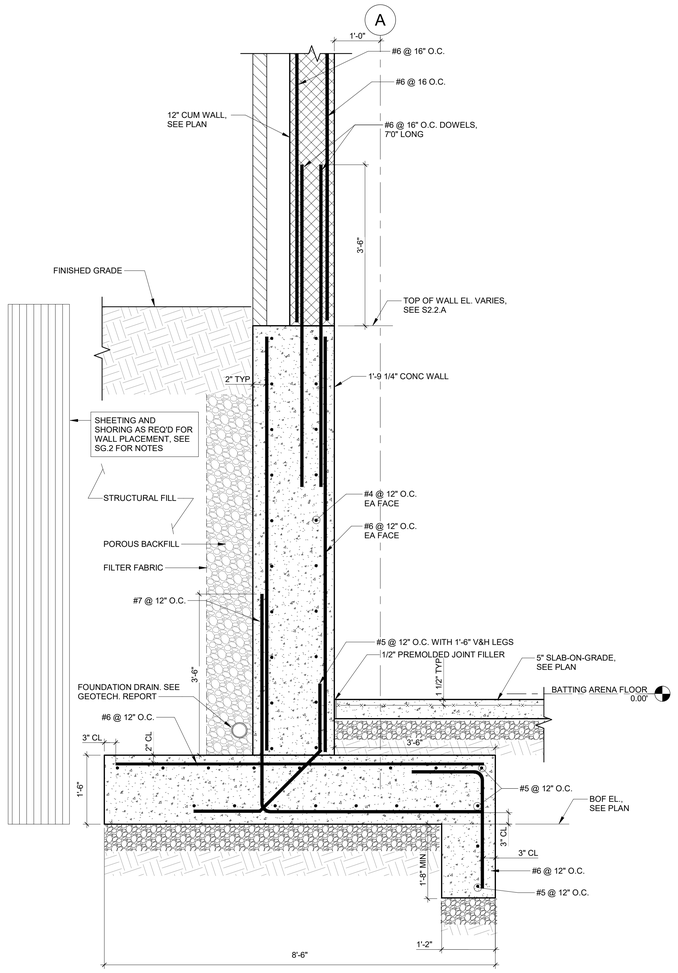


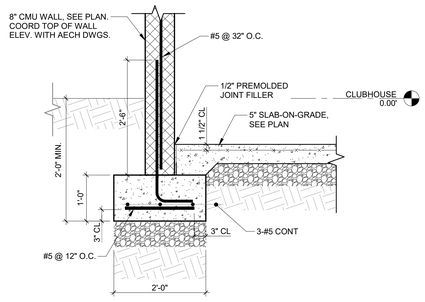
8 SECTION AT HOME CLUBHOUSE
SCALE: 3/4" = 1'-0"



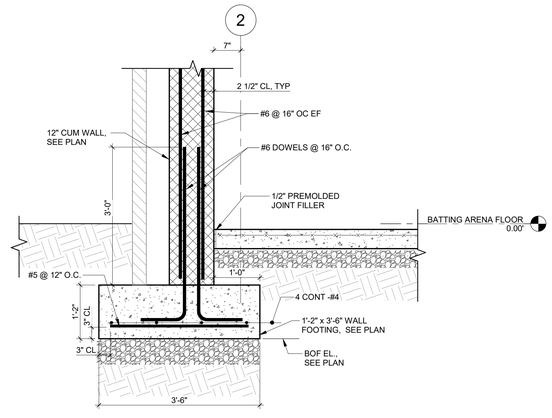
5 SECTION AT EXTERIOR WALL DOOR SILL
SCALE: 3/4" = 1'-0"



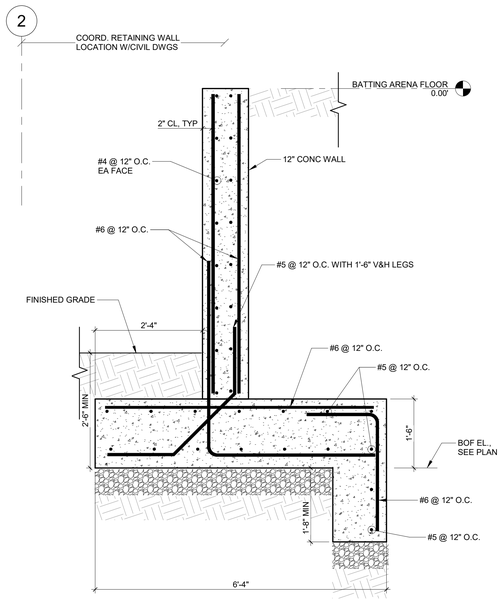
2 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"



7 SECTION AT HOME CLUBHOUSE
SCALE: 3/4" = 1'-0"



4 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"



6 SECTION AT SITE RETAINING WALL
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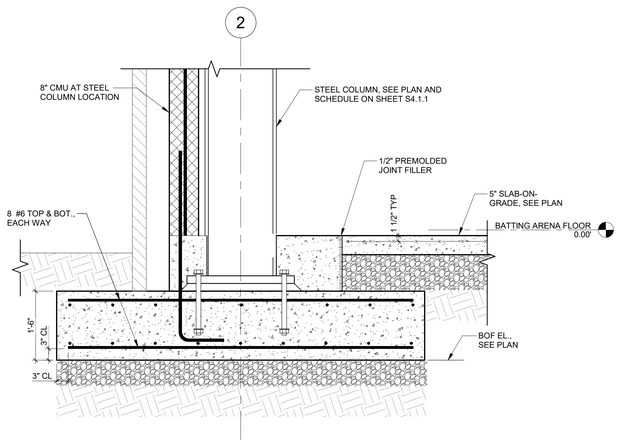
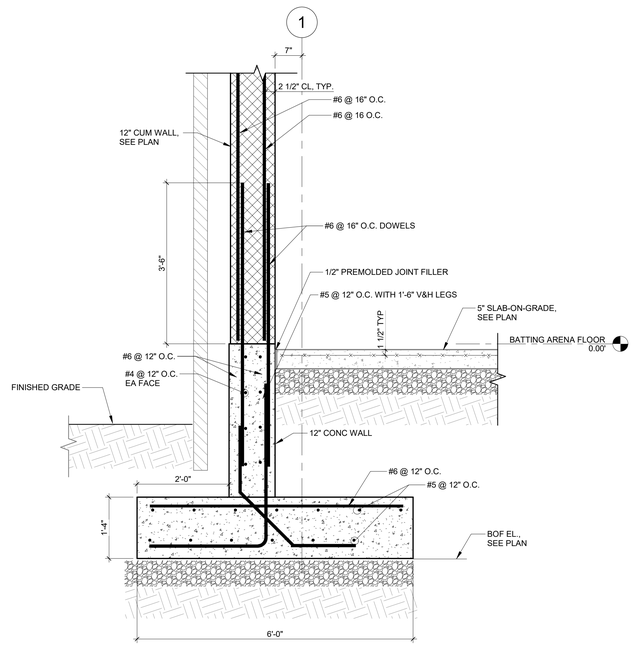


3 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"



1 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"

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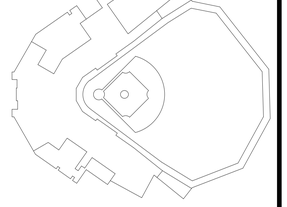

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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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PROJECT NO. 20230573 SCALE 3/4" = 1'-0"

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FOUNDATION SECTIONS

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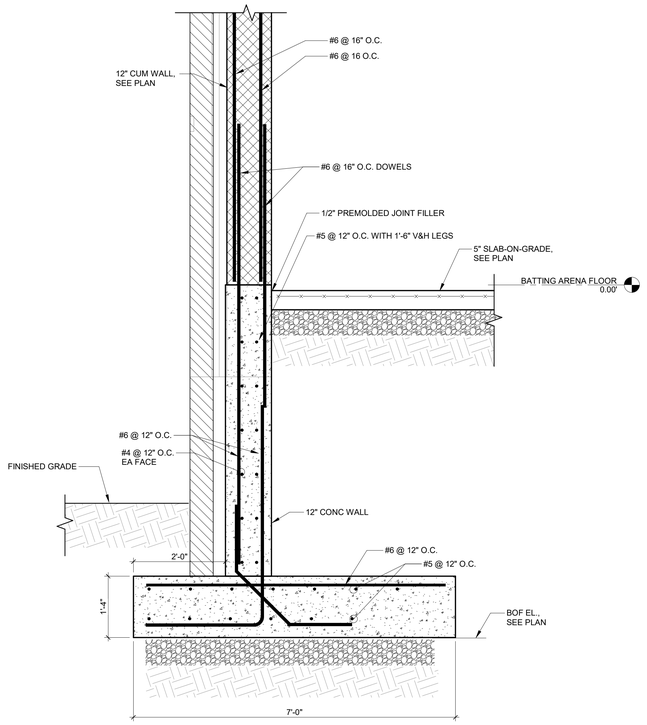

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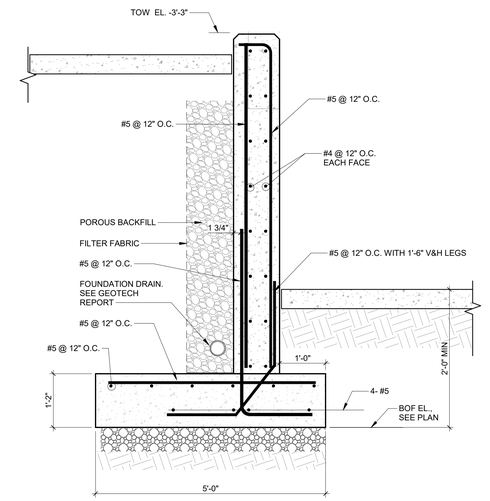

3 SECTION AT BULLPEN RETAINING WALL
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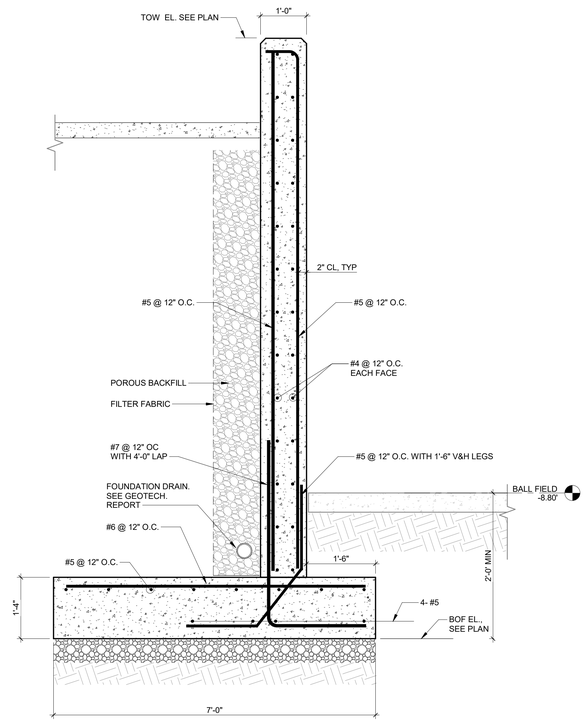

4 SECTION AT BULLPEN RETAINING WALL
SCALE: 3/4" = 1'-0"

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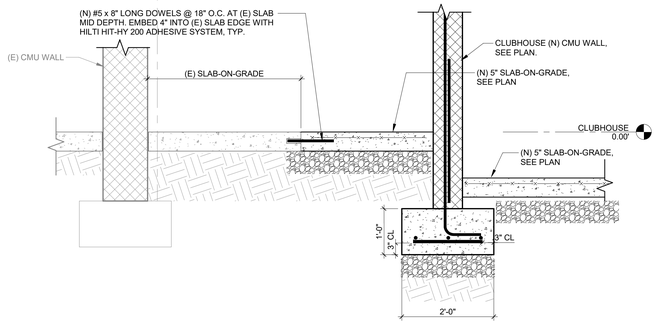
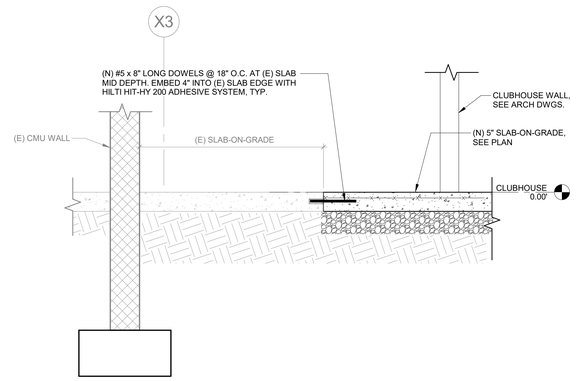


2 SECTION AT CLUBHOUSE
SCALE: 3/4" = 1'-0"

X3



1 SECTION AT HOME CLUBHOUSE
SCALE: 3/4" = 1'-0"

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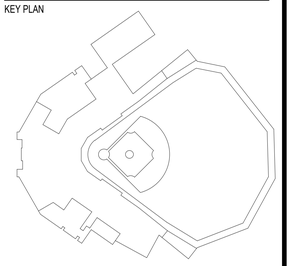

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ARTHUR PERDUE STADIUM IMPROVEMENTS

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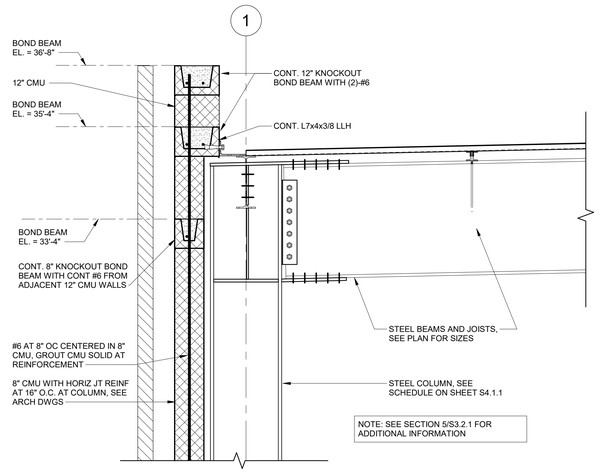

6 SECTION AT EXTERIOR WALL COLUMN
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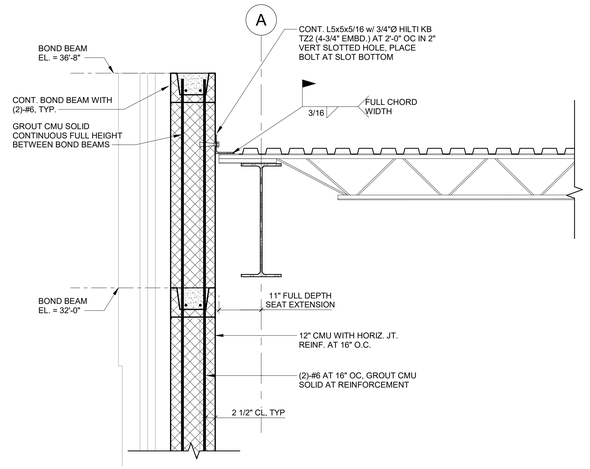
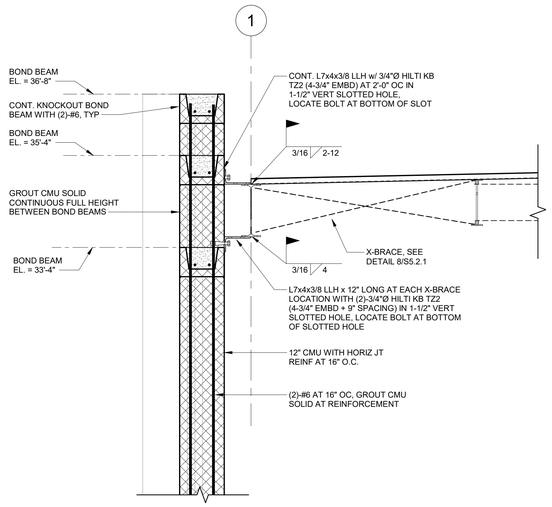
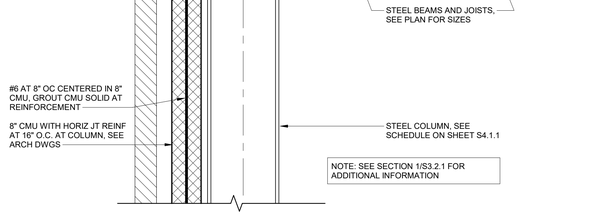


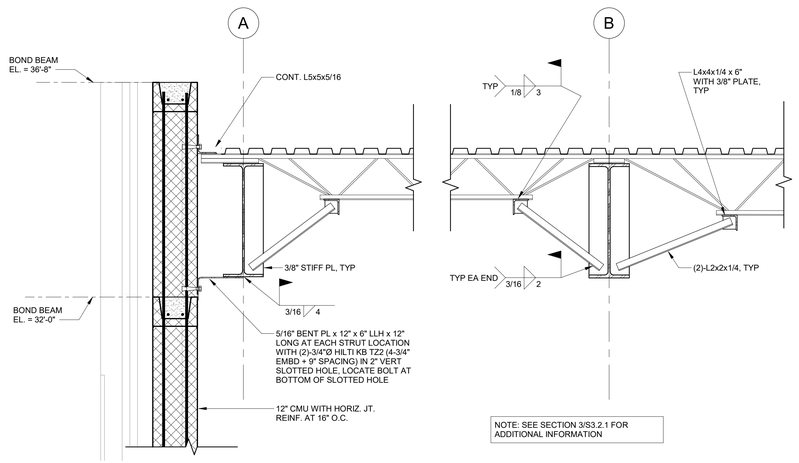
3 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"



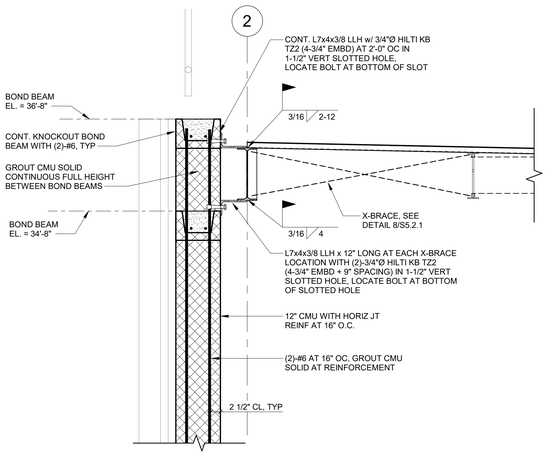
5 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"



2 SECTION AT EXTERIOR WALL COLUMN
SCALE: 3/4" = 1'-0"



4 SECTION AT STRUTS FOR ROOF BEAM
SCALE: 3/4" = 1'-0"



1 SECTION AT EXTERIOR WALL
SCALE: 3/4" = 1'-0"

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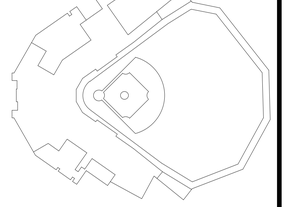

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DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 3/4" = 1'-0"
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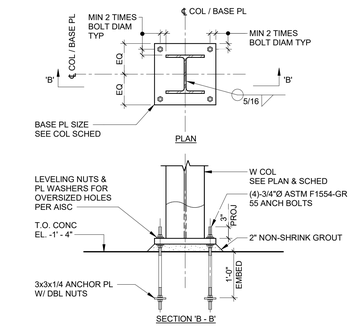
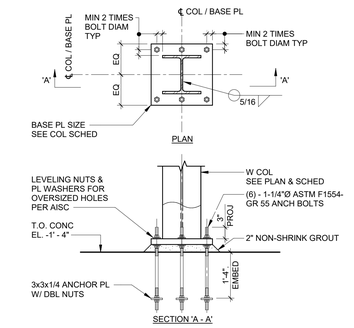
STEEL COLUMN SCHEDULE

		A-1	A-2	B-1	B-2	C-1	C-2	D-1	D-2	E-1	E-2	F-1	F-2	G-1	G-2	H-1	H-2	I-1	I-2	
BATTING ARENA ROOF																				BATTING ARENA ROOF
VARIES, SEE PLAN		W12X65	W12X65	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W18X97	W12X65	W12X65	VARIES, SEE PLAN
BATTING ARENA FLOOR																				BATTING ARENA FLOOR
0'-0"																				0'-0"
COLUMN LOCATIONS		A-1	A-2	B-1	B-2	C-1	C-2	D-1	D-2	E-1	E-2	F-1	F-2	G-1	G-2	H-1	H-2	I-1	I-2	COLUMN LOCATIONS
BASE PLATE	SIZE N.-S./N.W.-S.E.	18"	18"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	18"	18"	SIZE N.-S./N.W.-S.E.
	SIZE E.-W./N.E.-S.W.	18"	18"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	28"	18"	18"	SIZE E.-W./N.E.-S.W.
	THICKNESS	1"	1"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	1"	1"	THICKNESS
	BASE PLATE TYPE	B	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	BASE PLATE TYPE
COLUMN SUPPORT / COLUMN LOCATION																				COLUMN LOCATION / COLUMN SUPPORT



2 TYPICAL DETAIL - COLUMN BASE PLATE TYPE 'B'
SCALE: 3/4" = 1'-0"



1 TYPICAL DETAIL - COLUMN BASE PLATE TYPE 'A'
SCALE: 3/4" = 1'-0"

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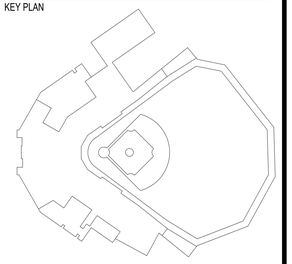

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D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24
C	EC	ISSUE 3: STEEL	6/4/24
B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

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COLUMN SCHEDULE AND DETAILS

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LINTEL SCHEDULE

MARK	MASONRY AND BRICK LINTEL	DETAIL(S) 2/S4.1.2	BEARING DETAIL 1/S4.1.2
L1	W8x15	D1	B2
L2	W16x40	D1	B2
L3	W8x24	D1	B2
L4			

1. SEE 1/S4.1.2 AND 2/S4.1.2 FOR TYPICAL LINTEL AND BEARING DETAILS.

2. ALL LOOSE LINTELS, BOTTOM PLATES, AND SILL ANGLES IN EXTERIOR WALLS SHALL BE HOT DIPPED GALVANIZED.

3. PROVIDE ONE OF THE FOLLOWING ANGLES, LLV, FOR EACH 4" OF WALL THICKNESS AT SCUPPERS, & MISCELLANEOUS ELECT. OR MECH. PENETRATONS OF INTERIOR & EXTERIOR MASONRY WALLS:
   R.O. > 0'-8", ≤ 2'-0": L4x3 1/2x3/8 LLV
   R.O. > 2'-0", < 4'-0": L5x3 1/2x3/8 LLV
   NO LINTEL IS REQUIRED AT R.O. < 0'-8".
   SEE MECHANICAL DWGS. FOR LOCATIONS & 1/S4.1.2 FOR BEARING DETAIL.

4. NOTIFY ARCHITECT IF LINTEL SIZE IS NOT PROVIDED FOR OPENING OR SPAN LIMIT INDICATED IN NOTES 3 & 5 IS EXCEEDED.

5. UNLESS NOTED OTHERWISE, FOR OPENINGS IN INTERIOR, NON-BEARING CMU WALLS PROVIDE THE FOLLOWING WITH 8" BRG. EA. END. R.O. = "ROUGH OPENING:"

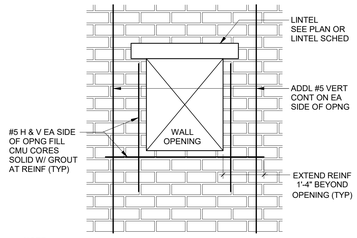
   4" CMU: (PRECAST CONC.)
   R.O. ≤ 4'-0" - 4"x8" w/ 1-#3 TOP & BOT.
   4'-0" < R.O. ≤ 6'-8" - 4"x8" w/ 1-#4 TOP & BOT.

   6" CMU: (PRECAST CONC.)
   R.O. ≤ 8'-0" - 6"x8" w/ 1-#3 TOP & 1-#5 BOT.

   8" CMU(U.N.O.):
   BOND BEAM WITH 2-#5 AND 8" MASONRY BEARING EACH END FOR MAXIMUM 6'-0" OPENING.

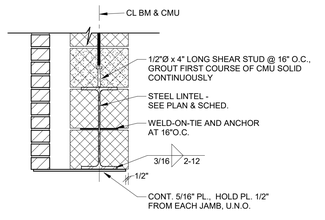
6. AT LOCATIONS WHERE TWO OPENINGS OPPOSE EACH OTHER WITH LESS THAN 12" OF MASONRY BETWEEN THEM, PROVIDE ONE CONTINUOUS LINTEL OVER BOTH OPENINGS OF THE SIZE GOVERNED BY THE LARGER ROUGH OPENING DIMENSION.

7. PROVIDE TEMPORARY SHORING FOR LINTELS TO PREVENT THEIR ROTATION UNTIL AFTER MASONRY INSTALLATION IS COMPLETED.



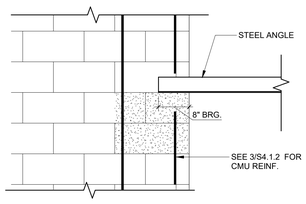
NOTE:
1. CMU LINTELS TO BE SHORED UNTIL MORTAR & GROUT EACH REACH ITS SPECIFIED 28 DAY COMPRESSIVE STRENGTH.
2. WHERE LENGTH OF WALL BETWEEN OPENINGS IS 2'-8 AND LESS, PROVIDE HORIZONTAL JOINT REINFORCEMENT EVERY COURSE.
3. SEE ARCH/MECH/PLUMB/ELECT DWGS FOR SIZE AND LOCATION OF WALL OPENINGS.

3 TYPICAL DETAIL - REINFORCEMENT AT MASONRY WALL OPENINGS
SCALE: 1/2" = 1'-0"

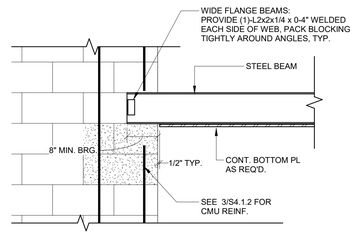


D1

2 TYPICAL LINTEL DETAILS
SCALE: 1" = 1'-0"



B1



B2

1 TYPICAL LINTEL BEARNING DETAILS
SCALE: 3/4" = 1'-0"

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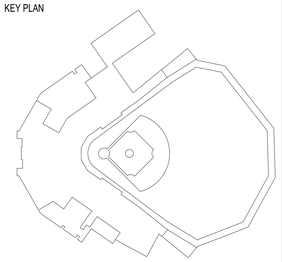

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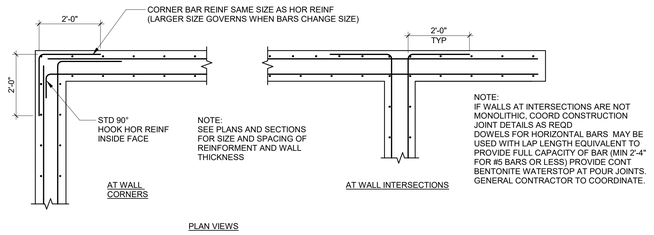
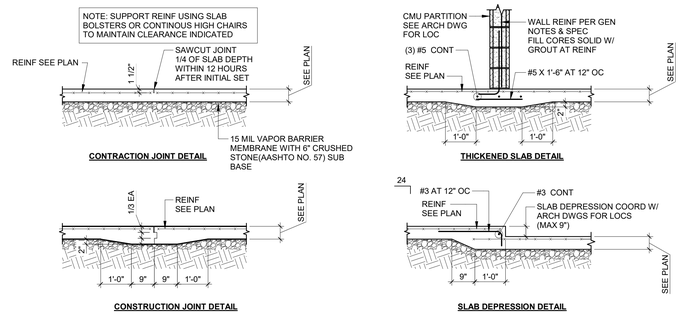
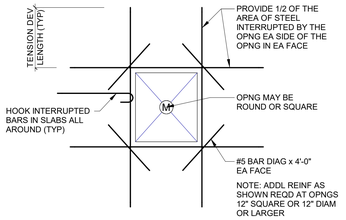


7 TYPICAL DETAIL - DOUBLE LAYER REINFORCING FOR CONCRETE WALLS
SCALE: 1/2" = 1'-0"



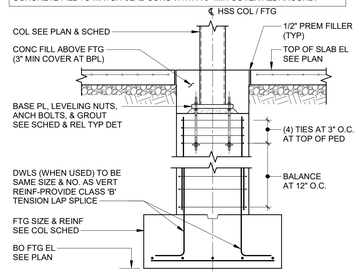
3 TYPICAL DETAIL - SLAB ON GRADE
SCALE: 1/2" = 1'-0"

NOTE:
1. INTERRUPTED BARS AT OPNG WOULD BE TOP AND/OR BOT BARS IN SLABS, OR VERT AND/OR HOR BARS IN WALLS (NOT SHOWN FOR CLARITY)
2. FOR SLAB OR WALL THICKNESS < 10" USE A SINGLE LAYER REINF CENTERED ON WALL / SLAB THICKNESS
3. FOR SLAB OR WALLS 10" THK OR >, PROVIDE BARS EA FACE.



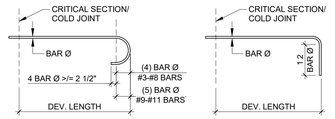
10 TYPICAL DETAIL - REINFORCING AT WALL OR SLAB OPENING
SCALE: 1/2" = 1'-0"

*BLOCKOUT FILL ABOVE FOOTING AROUND COLUMN TO CONFORM WITH LINES OF ADJACENT CONN WALLS, ARCHITECTURAL WALL, SHELF ELEVATION, ETC CONCRETE FILL TO MATCH SLAB CONC WITH A 3" MIN COVER ALL AROUND.

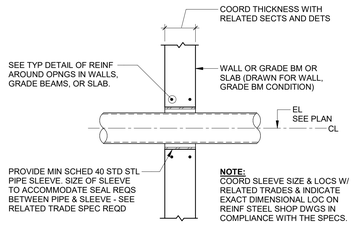


6 TYPICAL DETAIL - COLUMN FOOTING WITH PEDESTAL
SCALE: 1/2" = 1'-0"

STANDARD HOOK TENSION DEVELOPMENT LENGTHS (UNCOATED BARS) (IN.)								
CONC	3,000 PSI		3,500 PSI		4,000 PSI		5,000 PSI	
BARS	NW	LW	NW	LW	NW	LW	NW	LW
#3	9	11	8	11	8	10	7	9
#4	11	15	11	14	10	13	9	11
#5	14	18	13	17	12	16	11	14
#6	17	22	16	21	15	19	13	17
#7	20	25	18	24	17	22	15	20
#8	22	29	21	28	19	25	17	23
#9	25	33	23	31	22	28	20	25
#10	28	36	26	35	24	31	22	28
#11	31	40	29	39	27	34	24	31

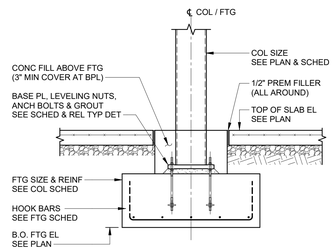


2 STANDARD HOOK DEVELOPMENT LENGTHS
SCALE: 1/2" = 1'-0"



9 TYPICAL DETAIL - PIPE/CONDUIT SLEEVE THRU FOUNDATION WALL
SCALE: 1/2" = 1'-0"

* BLOCKOUT FILL ABOVE FOOTING AROUND COLUMN TO CONFORM WITH LINES OF ADJACENT CONN WALLS, ARCHITECTURAL WALL, SHELF ELEVATION, ETC CONCRETE FILL TO MATCH SLAB CONC WITH A 3" MIN COVER ALL AROUND.



5 TYPICAL DETAIL - COLUMN FOOTING WITHOUT PEDESTAL
SCALE: 1/2" = 1'-0"

TENSION DEVELOPMENT LENGTHS (UNCOATED BARS)																				
BAR SIZE	3,000 PSI CONCRETE				3,500 PSI CONCRETE				4,000 PSI CONCRETE				4,500 PSI CONCRETE				5,000 PSI CONCRETE			
	l_d PER SPACING AND COVER				l_d PER SPACING AND COVER				l_d PER SPACING AND COVER				l_d PER SPACING AND COVER				l_d PER SPACING AND COVER			
	CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2	
	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS
#3	22	17	32	25	20	16	30	23	19	15	28	22	18	14	27	21	17	13	25	20
#4	29	22	43	33	27	21	40	31	25	19	37	29	24	18	35	27	23	17	34	26
#5	36	28	54	41	33	26	50	39	31	24	47	36	30	23	44	34	28	22	42	32
#6	43	33	64	50	40	31	60	46	37	29	56	43	35	27	53	41	34	26	50	39
#7	63	48	94	72	58	45	87	67	54	42	81	63	51	40	77	59	49	38	73	56
#8	72	55	107	82	66	51	99	77	62	48	93	71	59	45	88	68	56	43	83	64
#9	81	62	121	93	75	58	112	86	70	54	105	81	66	51	99	76	63	48	94	72
#10	91	70	136	105	83	64	124	96	79	61	118	91	73	56	110	84	69	54	104	80
#11	101	78	151	116	91	70	136	105	87	67	131	101	80	62	120	93	76	59	114	88

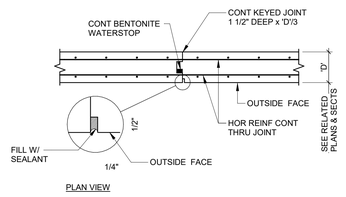
TENSION SPLICE LENGTHS (UNCOATED BARS)																				
BAR SIZE	3,000 PSI CONCRETE				3,500 PSI CONCRETE				4,000 PSI CONCRETE				4,500 PSI CONCRETE				5,000 PSI CONCRETE			
	LAP LENGTH PER SPACING AND COVER				LAP LENGTH PER SPACING AND COVER				LAP LENGTH PER SPACING AND COVER				LAP LENGTH PER SPACING AND COVER							
	CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2		CASE 1		CASE 2	
	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS	TOP BARS	OTHERS
#3	28	22	42	32	26	21	39	30	24	19	36	28	24	19	36	28	23	17	33	26
#4	37	29	56	43	36	28	52	41	32	25	48	37	32	24	46	36	30	23	45	34
#5	47	36	70	54	43	34	65	51	40	31	60	47	39	30	58	45	37	29	55	42
#6	56	43	84	64	52	41	78	60	48	37	72	56	46	36	69	54	45	34	65	51
#7	81	63	122	94	76	59	114	88	70	54	106	81	67	52	101	77	64	50	95	73
#8	93	72	139	107	86	67	129	101	80	62	121	93	77	59	115	89	73	56	108	84
#9	105	81	157	121	98	76	146	112	91	70	136	105	86	67	129	99	82	63	123	94
#10	118	91	177	136	108	84	162	125	102	79	153	118	95	73	143	110	90	71	136	104
#11	131	101	196	151	119	91	177	137	113	87	170	131	104	81	156	121	99	77	149	115

NOTES ON BAR SPLICES

1. CASE 1 - BEAMS AND COLUMNS:
   CONCRETE COVER ≥ db, C.-C. BAR SPACING ≥ 2db AND WITH STIRRUPS OR TIES THROUGHOUT l_d NOT LESS THAN THE CODE MINIMUM
   OTHER MEMBERS: CONCRETE COVER ≥ db, C.-C. BAR SPACING ≥ 3db
   CASE 2 - BEAMS AND COLUMNS:
   CONCRETE COVER < db AND C.-C. BAR SPACING < 2db
   OTHER MEMBERS: CONCRETE COVER < db OR C.-C. BAR SPACING < 3db
2. VERTICAL COLUMN REINFORCING SHALL BE A CONTINUOUS BAR WHENEVER POSSIBLE. IF SPLICES ARE REQUIRED USE LAP LENGTHS SHOWN AND SUBMIT FOR ENGINEER'S APPROVAL.
3. SPLICES FOR VERTICAL BARS IN WALLS SHALL BE AS SHOWN. SPLICES FOR HORIZONTAL BARS SHALL BE LOCATED:
   (A.) AT PIERS (COLUMNS) FOR INSIDE REBARS
   (B.) IN BETWEEN PIERS FOR OUTSIDE REBARS
4. SPLICES AND DEVELOPMENT LENGTHS FOR EPOXY COATED REBARS SHALL BE INCREASED BY 20 PERCENT FROM THE VALUES SHOWN IN THE TABLES.
5. ALL SPLICES SHALL BE CLASS B TENSION LAP SPLICES. (UNLESS NOTED OTHERWISE)
6. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12" OF CONCRETE CAST BELOW BARS.
7. ALL LENGTHS SHOWN ARE IN INCHES.

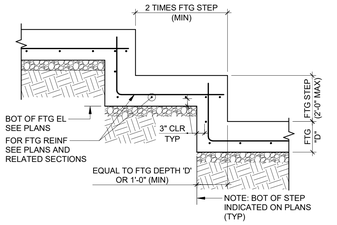
1 TENSION DEVELOPMENT & SPLICE LENGTHS FOR UNCOATED BARS
SCALE: 1/2" = 1'-0"

NOTE:
1. PROVIDE CONSTRUCTION JOINTS IN CONCRETE WALLS AT 80'-0" OC MAX (SEE PLANS). CONSTRUCTION JOINTS SHALL BE LOCATED WITHIN THE MIDDLE THIRD OF SPAN WHERE WALLS ARE EXPOSED TO THE EXTERIOR. SUBMIT A DRAWING OF ALL PROPOSED WALL JOINTS FOR ARCHITECTS REVIEW.



8 TYPICAL DETAIL - CONCRETE WALL CONSTRUCTION JOINT
SCALE: 1/2" = 1'-0"

NOTE:
COORDINATE STEP LOCATIONS WITH PLANS.
FIRST STEP FROM COLUMN FOOTING (MINIMUM 2'-0")



4 TYPICAL DETAIL - STEPPED FOOTING WITH BOTTOM REINFORCEMENT
SCALE: 1/2" = 1'-0"

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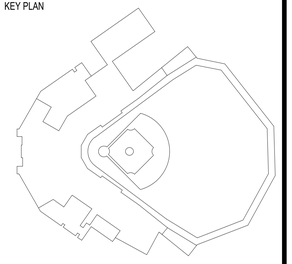

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REVISIONS

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B	EC	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

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PROJECT NO. 20230573 SCALE 1/2" = 1'-0"
DRAWING NAME
TYPICAL DETAILS

PHASE
CD

DRAWING NO.
S5.1.1

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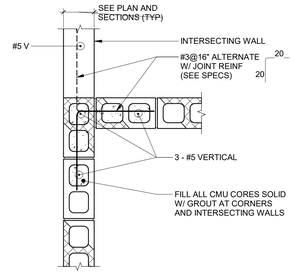
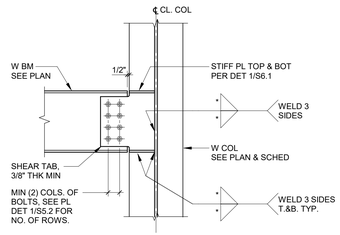
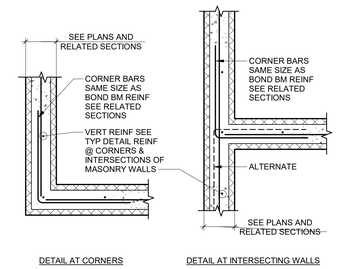


7 TYPICAL DETAIL - REINFORCEMENT AT CORNERS AND INTERSECTING MASONRY WALLS
SCALE: 1/2" = 1'-0"

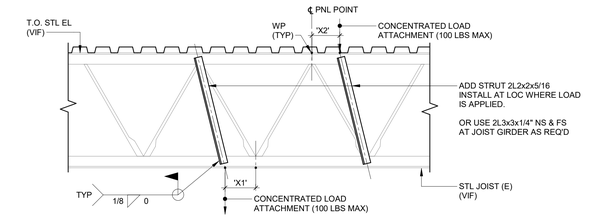


NOTE:
1. SEE SPECIFICATIONS FOR CONNECTION DESIGN REQUIREMENTS.
2. ALL CONN'S. TO BE MADE WITH MIN 3/4"∅ ASTM A325-N HEAVY HEX HEAD BOLTS, UNLESS OTHERWISE NOTED.
3. WELDS INDICATED THUS (*) SHALL BE MINIMUM 1/4" FILLET WELDS.
4. HIGH STRENGTH HEAVY HEX HEAD BOLTS WILL NOT BE PERMITTED IN THE "SNUG TIGHT" CONDITION. ALL HIGH TENSILE BOLTS MUST BE TORQUED TO SPECIFIED VALUE AS NOTED IN AISC SPECIFICATION FOR STRUCTURAL JOINTS.

3 TYPICAL DETAIL - EXTENDED SHEAR TAB CONNECTION
SCALE: 3/4" = 1'-0"

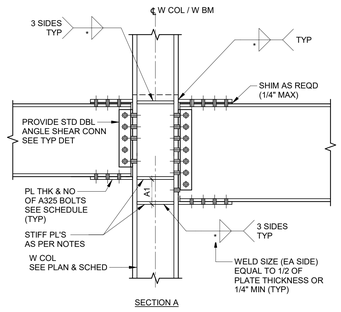


6 TYPICAL DETAIL - BOND BEAM REINFORCEMENT
SCALE: 1/2" = 1'-0"

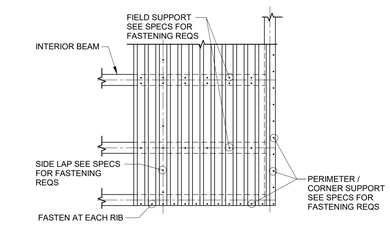


NOTES:
1. ALL CONCENTRATED LOADS IN EXCESS OF 100 LBS MUST BE SUPPORTED AT JOIST PANEL POINTS ONLY. MISCELLANEOUS STEEL FABRICATOR / CONTRACTOR SHALL PROVIDE AL NECESSARY SUB-FRAMING AND CONNECTIONS TO ENSURE SATISFACTORY TRANSFER OF LOADS AT JOIST PANEL POINTS. BEFORE FABRICATION AND INSTALLATION OF ANY SUPPORT, MISCELLANEOUS STEEL FABRICATOR / CONTRACTOR MUST SEEK APPROVAL FROM EOR.
2. STRUT SHALL BE REQ'D AT ALL HVAC UNIT SUPPORTS UNLESS SUPPORT IS AT PANEL POINT OF JOIST OR JOIST GIRDER.
3. STRUT IS NOT REQ'D IF 'X1' OR 'X2' IS LESS THAN 3". REINFORCING STRUTS WHERE REQUIRED SHALL BE BY THE MISCELLANEOUS STEEL FABRICATOR.

2 TYPICAL DETAIL - STEEL JOIST REINFORCEMENT AT CONCENTRATED LOADS
SCALE: 3/4" = 1'-0"



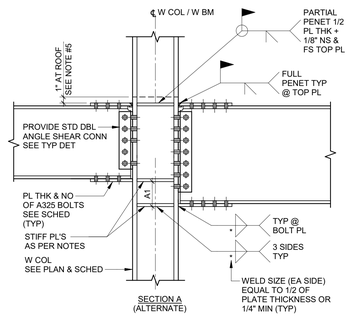
GRAVITY & LATERAL MOMENT CONNECTION NOTES:
1. PROVIDE LATERAL MOMENT CONNECTIONS AT ALL BEAM / COLUMN JOINTS INDICATED THUS ⟵◀ IN PLAN.
2. THE STEEL FABRICATOR SHALL DESIGN THE LATERAL MOMENT CONNECTIONS AS DETAILED. THE DESIGN OF THESE CONNECTIONS SHALL BE PERFORMED BY A STRUCTURAL ENGINEER, LICENSED IN THE STATE OF MARYLAND AND EMPLOYED BY THE STEEL FABRICATOR.
3. BEAM END REACTIONS AND MOMENTS SHOWN ON PLAN ARE FACTORED LOADS BASED ON LOAD AND RESISTANCE FACTORED DESIGN. ALL BEAMS WITH NO END REACTIONS SHOWN SHALL BE DESIGNED FOR A MINIMUM FACTORED LOAD OF 15 KIPS.
4. WELD SIZES INDICATED THUS (*) ARE TO BE DETERMINED BY THE STEEL FABRICATOR'S ENGINEER BASED UPON THE SPECIFIED LOADING. FILLET WELDS SHALL BE A MINIMUM OF 1/4 INCH FILLET WELDS. ALL AISC PREQUALIFIED WELD DESIGNATIONS SHALL BE INDICATED ON THE SHOP DRAWINGS FOR REVIEW.
5. FABRICATOR'S NOTE: FOR ALL CJP WELDS, DO NOT PROVIDE WELD ACCESS HOLES IN ACCORDANCE WITH AISC RECOMMENDATIONS.
6. THE CONNECTION DETAILS ON THIS DRAWING ARE FOR ILLUSTRATION OF CONCEPT ONLY. ACTUAL NUMBER OF BOLTS, WELD SIZE, GEOMETRY, ETC. SHALL BE DETERMINED BY THE STEEL FABRICATORS ENGINEER.
7. WHEN DIMENSION A1 IS GREATER THAN 3 INCHES PROVIDE A FITTED STIFF PLATE BETWEEN THE COLUMN FLANGES. THE THICKNESS OF THE STIFF PLATE SHALL EQUAL THE THICKNESS OF THE BOTTOM LATERAL MOMENT PLATE FOR THE BEAM FRAMING TO COL FLANGE.
8. TRIM METAL DECKING AT LATERAL MOMENT CONNECTIONS AND COLUMN, AS REQUIRED, TO LAY FLAT, TYPICAL.
9. SUBMIT COMPLETE LATERAL MOMENT CONNECTION CALCULATIONS, SIGNED AND SEALED BY THE STEEL FABRICATORS ENGINEER, PRIOR TO SUBMISSION OF RELATED STRUCTURAL PIECE DRAWINGS.

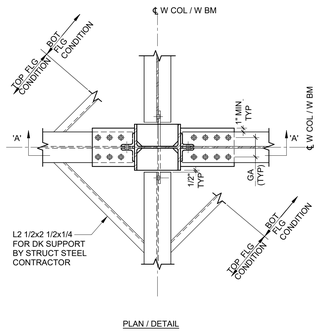


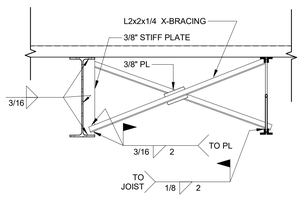
NOTES:

ALL FASTENING OF METAL DECK TO STEEL SHALL BE MADE WITH POWDER DRIVEN FASTENERS OR PUDDLE WELDS. PUDDLE WELDS SHALL BE 5/8 INCH DIAM FOR FLOOR DECKS, AND 3/4 INCH DIAM FOR ROOF DECKS. POWDER DRIVEN FASTENERS SHALL HAVE EQUIVALENT OR GREATER WORKING CAPACITY THAN 5/8 INCH DIAM PUDDLE WELD FOR FLOOR DECKS, AND 3/4 INCH DIAM FOR ROOF DECKS. SEE SPECIFICATIONS.

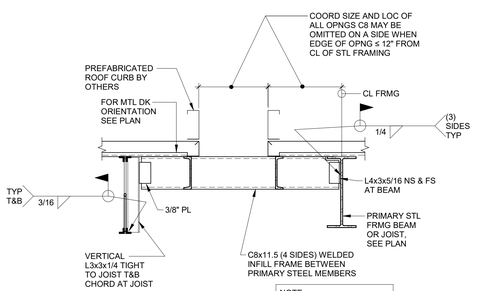
5 TYPICAL DETAIL - METAL DECK
SCALE: 3/4" = 1'-0"







8 TYPICAL DETAIL - X-BRACE
SCALE: 3/4" = 1'-0"



NOTE:
CONTRACTOR TO COORD LOCS OF ALL OPNGS FOR SHOP WELDING (TYP)

4 TYPICAL DETAIL - ROOF OPENING/MECHANICAL SUPPORT
SCALE: 3/4" = 1'-0"

1 TYPICAL DETAIL - LATERAL MOMENT CONNECTION
SCALE: 3/4" = 1'-0"

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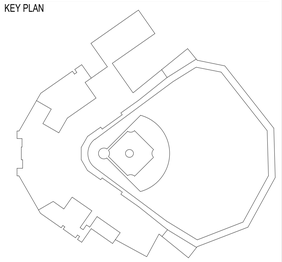
KEY PLAN



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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
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DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE As indicated
DRAWING NAME
TYPICAL DETAILS

PHASE CD
DRAWING NO. S5.2.1

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GENERAL NOTES

1. DEMOLITION NOTES

   a. ALL DUCTWORK, EQUIPMENT, FIXTURES, PIPING, CONDUITS, WIRING AND OTHER APPURTENANCES NOT SPECIFICALLY USED ON THIS PROJECT SHALL BE REMOVED FROM THE PROJECT AREA.
   b. ALL OPENINGS IN FLOORS CEILINGS, WALLS AND ROOFS SHALL BE PATCHED TO MATCH EXISTING STRUCTURE AN MAINTAIN CODE REQUIRED FIRE / SMOKE SEPARATION.

2. CONTRACTOR NOTES

   a. CONTRACTOR TO SUBMIT CPM SCHEDULE PRIOR TO THE FIRST CONSTRUCTION MEETING THAT INCLUDES:

      1. PROJECT SCHEDULE.
      2. SUBMITTAL REVIEW SCHEDULE ASSUMING 10 BUSINESS DAYS FOR SUBMITTAL REVIEW.
      3. CLOSE-IN INSPECTION
      4. FINAL INSPECTION
      5. COMMISSIONING

   a. WFT WILL RESPOND TO FIELD REQUEST FOR INFORMATION (RFI'S), WITHIN 5 BUSINESS DAYS OF RECEIPT.
   b. CONTRACTOR SHALL PROVIDE SUBMITTALS ONLY FOR MATERIALS AND EQUIPMENT SPECIFIED IN THE DOCUMENTS. IF THE CONTRACTOR PROVIDES SUBMITTALS THAT ARE NOT SPECIFICALLY REQUESTED (OR AN EQUIVALENT), THEY WILL NOT BE REVIEWED AND NOT BE RETURNED.
   c. CONTRACTOR SHALL PREPARE (IN A FORMAT DESIGNATED BY THE GC) COORDINATION DRAWINGS SHOWING ALL ELEMENTS OF STRUCTURE, SPECIFIC EQUIPMENT PROPOSED, SERVICE CLEARANCES AND SUPPORTS. FAILURE TO PROVIDE COORDINATION DRAWING WILL RESULT IN A BACK CHARGE (AT THE ENGINEERS PREVAILING RATES) FOR ADDITIONAL SITE VISITS TO ADDRESS FIELD COORDINATION ITEMS. A RETAINER WILL BE REQUIRED PRIOR TO ANY ACTIVITIES.
   d. THE CONTRACTOR WILL BE BACK CHARGED (AT THE ENGINEERS PREVAILING RATES) FOR SUBMITTAL REVIEW BEYOND 2 REVIEWS. A RETAINER WILL BE REQUIRED PRIOR TO THE START OF THE 3RD REVIEW.
   e. IF THE CONTRACTOR REQUESTS A FINAL PUNCH WALK-THRU AND THE SPACE IS NOT READY, THE CONTRACTOR SHALL BE BACK-CHARGED FOR THE ENGINEER'S TIME AT THE ENGINEERS PREVAILING RATES.
   f. IF THE CONTRACTOR REQUESTS PUNCH WALK-THRU AND SIGNIFICANT SYSTEM DEFICIENCIES EXIST, PREVENTING SYSTEM OPERATION AND VALIDATION, THE CONTRACTOR SHALL BE BACK-CHARGED FOR THE ENGINEER'S TIME AT THE ENGINEERS PREVAILING RATES.
   g. THE CONTRACTOR SHALL PAY IN ADVANCE $100 PER DRAWING FOR REPRODUCTION, TRANSFERRING, COPYING OF WFT DRAWINGS TO COVER THE COST OF PREPARING SAME.
   h. SYSTEM RACEWAY SHALL BE INSTALLED CONCEALED IN ALL FINISHED SPACES. CONTRACTOR SHALL COORDINATE RACEWAY TYPE AND COLOR WITHIN EXPOSED AREAS WITH ARCHITECT/BUILDING OWNER PRIOR TO INSTALLATION.
   i. RACEWAY IN CONCEALED SPACES SHALL MATCH EXISTING BUILDING STANDARD. CONTRACTOR SHALL COORDINATE REQUIREMENTS (TYPE AND COLOR) WITH ARCHITECT/BUILDING OWNER PRIOR TO INSTALLATION.
   j. FIRE ALARM DRAWINGS SHALL BE SUBMITTED AND APPROVED BY THE AHJ, PRIOR TO SUBMISSION TO WFT.

MECHANICAL ABBREVIATIONS

AC	AC UNIT
AHU	AIR HANDLING UNIT
AMS	AIR FLOW MONITORING STATION
A.P.	ACCESS PANEL
BAS	BUILDING AUTOMATION SYSTEM
CD	CEILING DIFFUSER
D	CONDENSATE DRAIN
(D)	DEMOLISH
DDC	DIRECT DIGITAL CONTROL
DN	DOWN
(E)	EXISTING
EF	EXHAUST FAN
ER	EXHAUST REGISTER
FCU	FAN COIL UNIT
FD	FIRE DAMPER
FSD	COMBINATION MOTORIZED SMOKE AND FIRE DAMPER
OED	OPEN END DUCT
SP	DUCT STATIC PRESSURE SENSOR
SR	SUPPLY REGISTER
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE

MECHANICAL LEGEND

	EXISTING TO REMAIN (THIN)
	NEW WORK (THICK)
	DEMO (THICK DASHED)
D	CONDENSATE DRAIN
X	DRAWING NOTE - MECHANICAL
	POINT OF DISCONNECT
	POINT OF CONNECTION
	DUCT W/ 1-INCH SOUND LINING
	DUCT W/ TURNING VANES
	EXHAUST DUCT UP
	EXHAUST DUCT DOWN
	RETURN DUCT UP
	RETURN DUCT DOWN
	SUPPLY DUCT UP
	SUPPLY DUCT DOWN
	SUPPLY DIFFUSER
	RETURN DIFFUSER
	FLEX DUCT
	PIPE TURNING DOWN
	PIPE TURNING UP
	PIPE CONTINUING
T	TEMPERATURE SENSOR
C	CO2 SENSOR
M	MOTORIZED DAMPER
	MANUAL AIR BALANCING DAMPER
FSD	COMBINATIN FIRE/SMOKE DAMPER

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DRAWING NAME
SYMBOLS, ABBREVIATIONS AND NOTES

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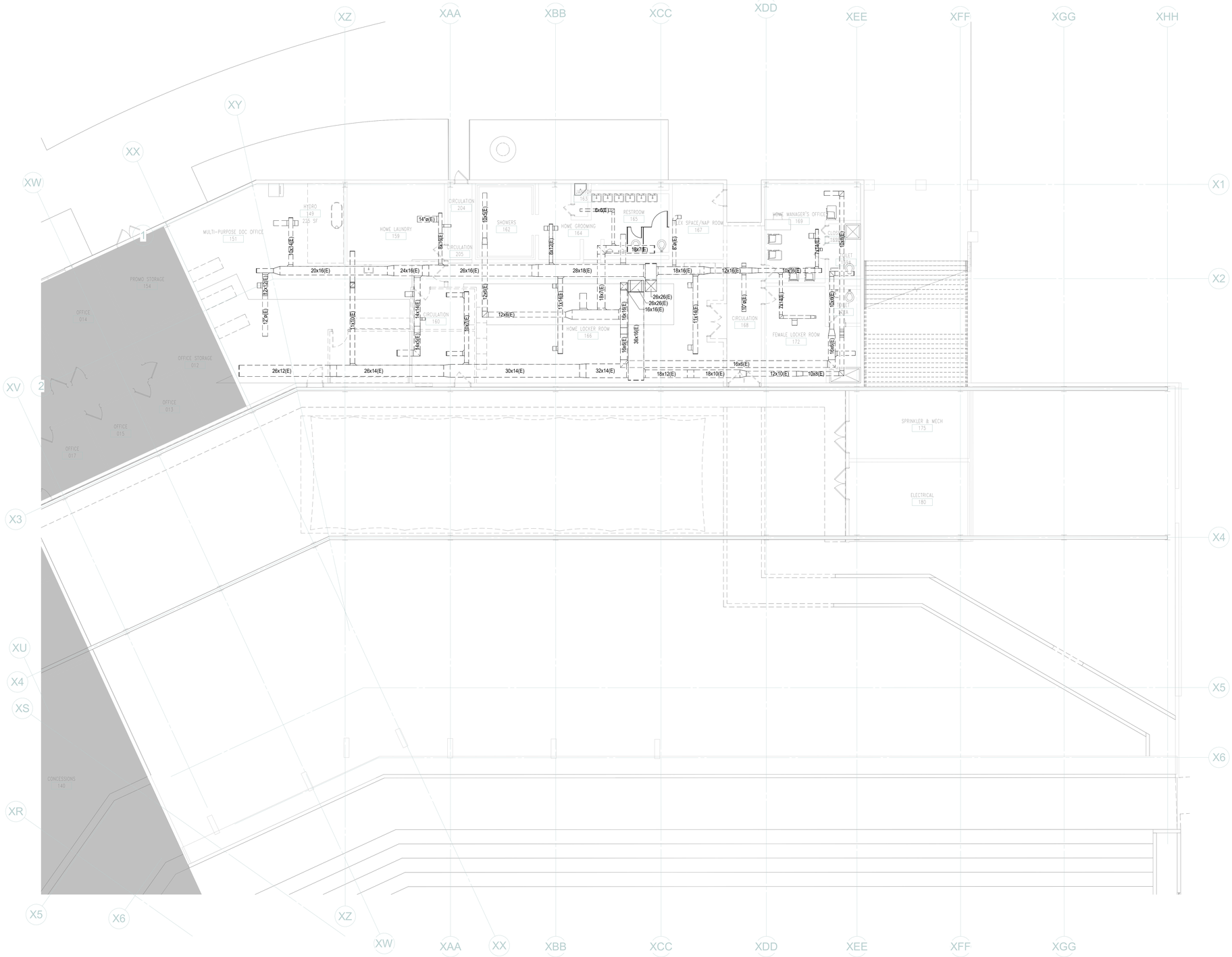

1 HOME CLUBHOUSE DEMO PLAN - MECHANICAL

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

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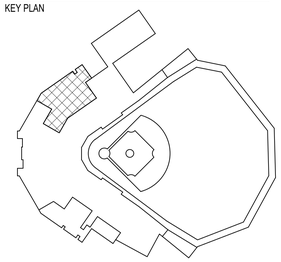

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HOME CLUBHOUSE - DEMO PLAN - MECHANICAL

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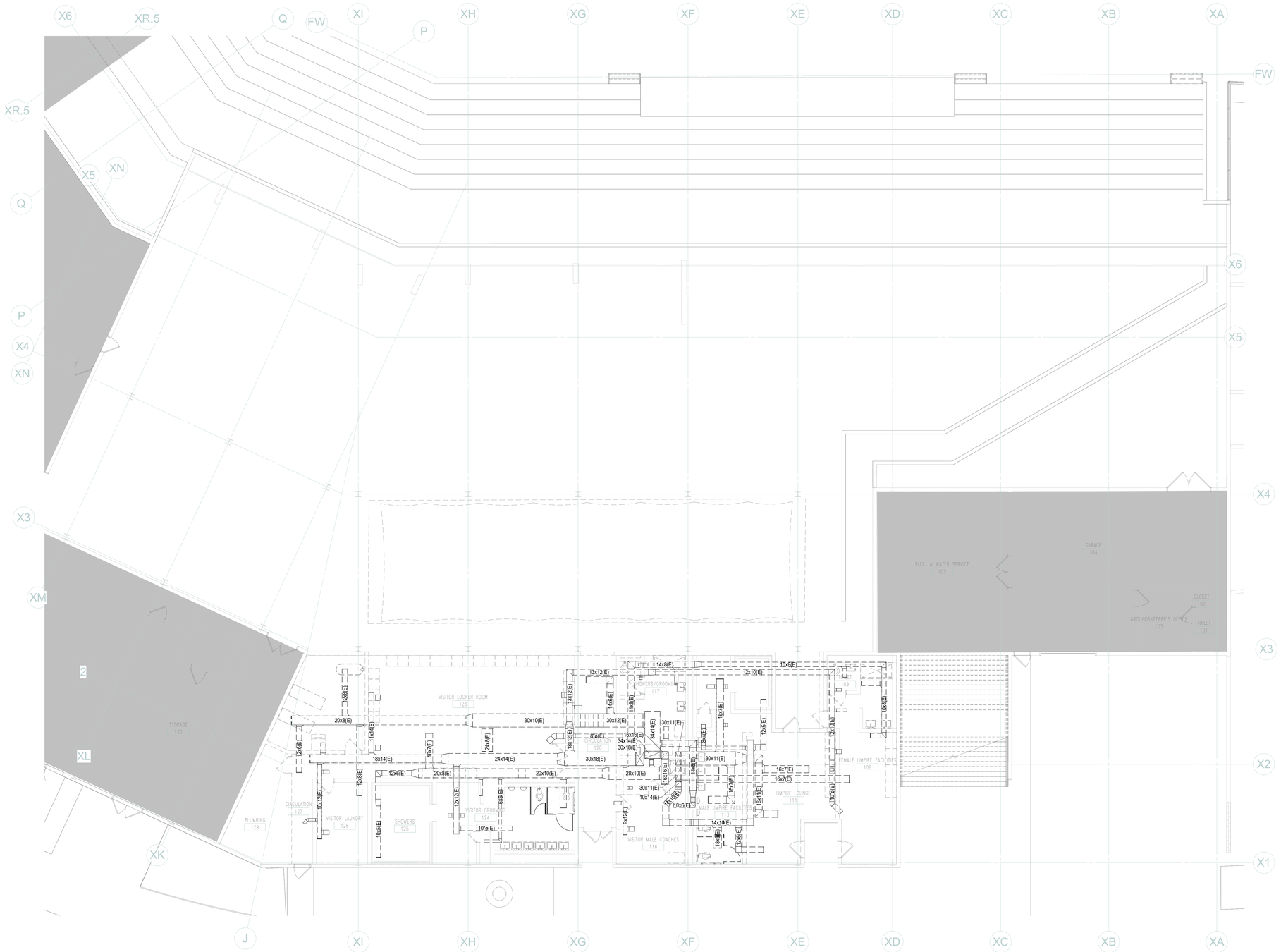

1 VISITOR CLUBHOUSE DEMO PLAN - MECHANICAL
SCALE: 1/8" = 1'-0"

SCALE : 1/8" = 1'-0"

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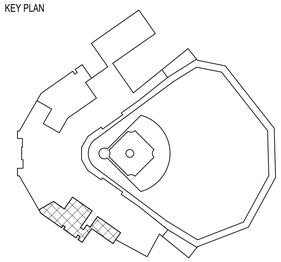

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VISITOR CLUBHOUSE - DEMO PLAN - MECHANICAL

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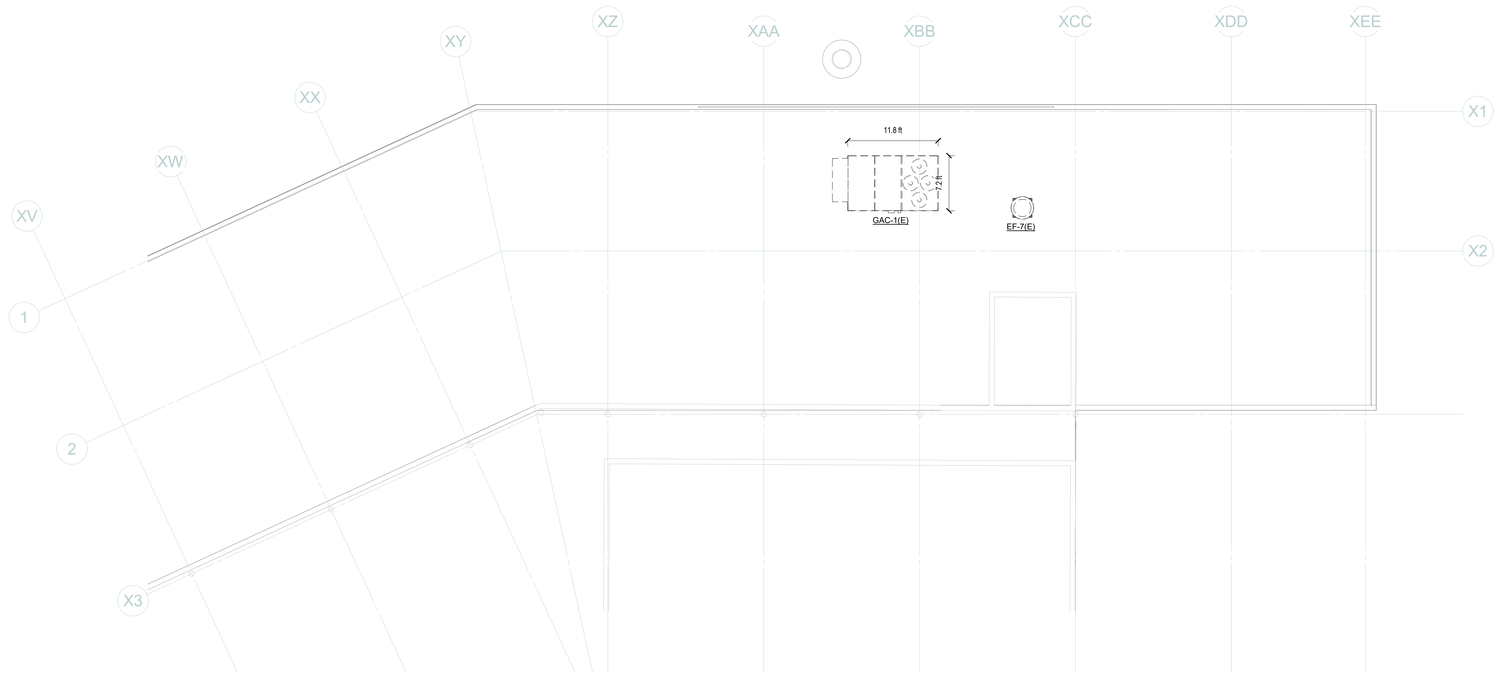
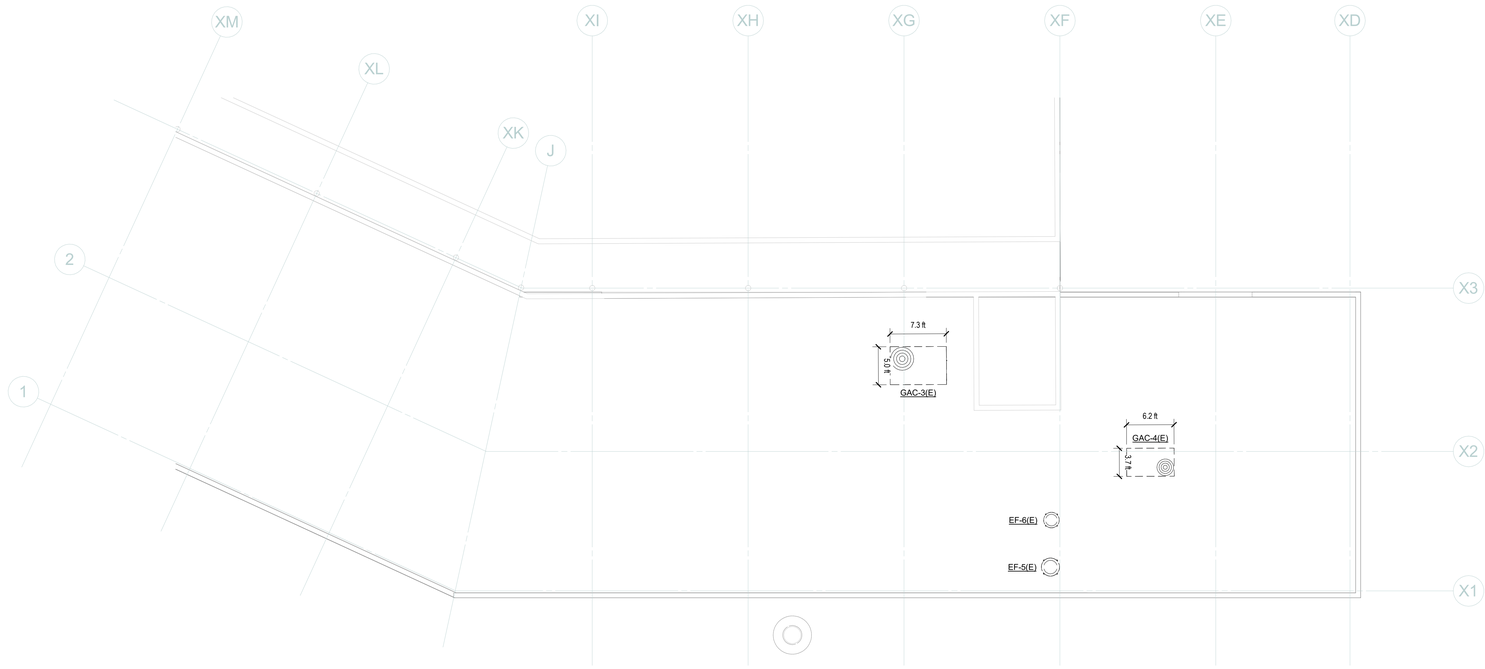


1 DEMO CLUBHOUSE ROOF PLAN - HOME - MECHANICAL

SCALE: 1/8" = 1'-0"



2 DEMO CLUBHOUSE ROOF PLAN - VISITOR -MECHANICAL

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

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CLUBHOUSE ROOF - DEMO PLANS - MECHANICAL

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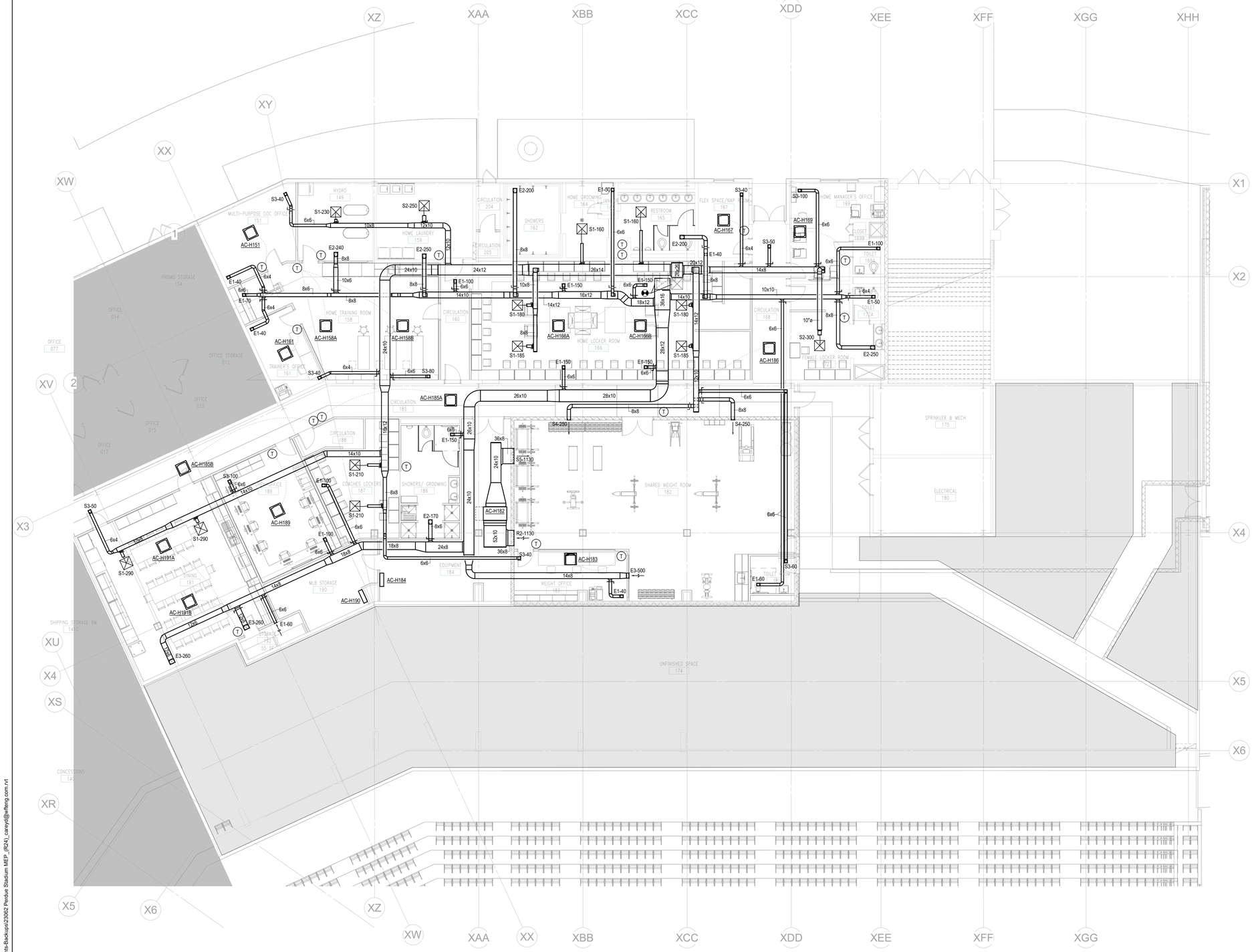

1 HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL

SCALE: 1/8" = 1'-0"

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Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
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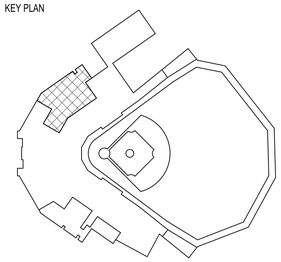
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG

PROJECT MANAGER
TR

Project Architect
SN

Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	WFT	ISSUE 4: CONSTRUCTION DOCUMENTS	6/21/24
B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL

PHASE
CD

DRAWING NO.
M1.1.1

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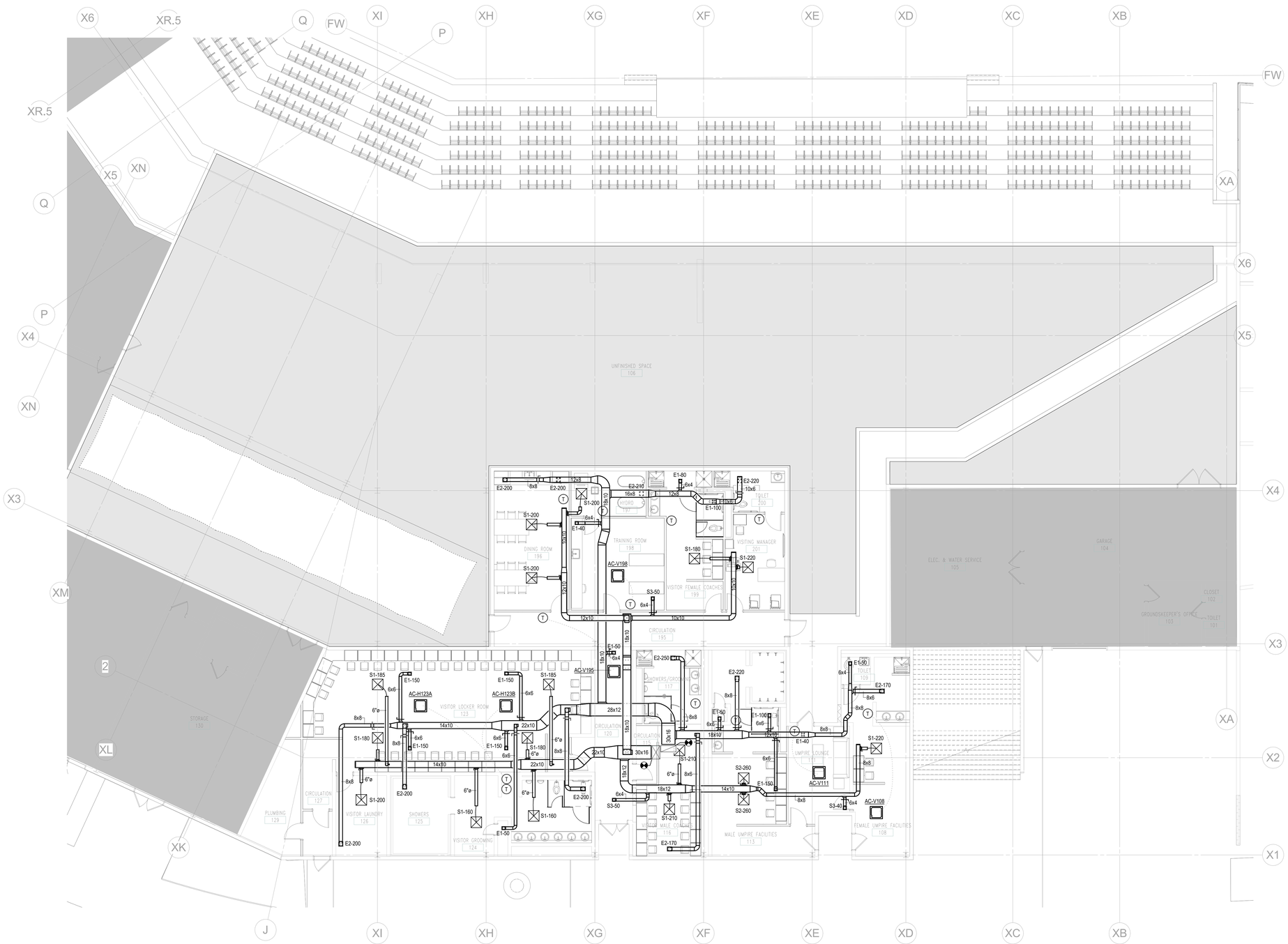

1 VISITOR CLUBHOUSE NEW WORK PLAN - MECHANICAL
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

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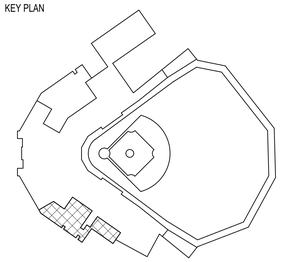

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DRAWING NAME

VISITOR CLUBHOUSE NEW WORK PLAN - MECHANICAL

PHASE
CD

DRAWING NO.
M1.1.2

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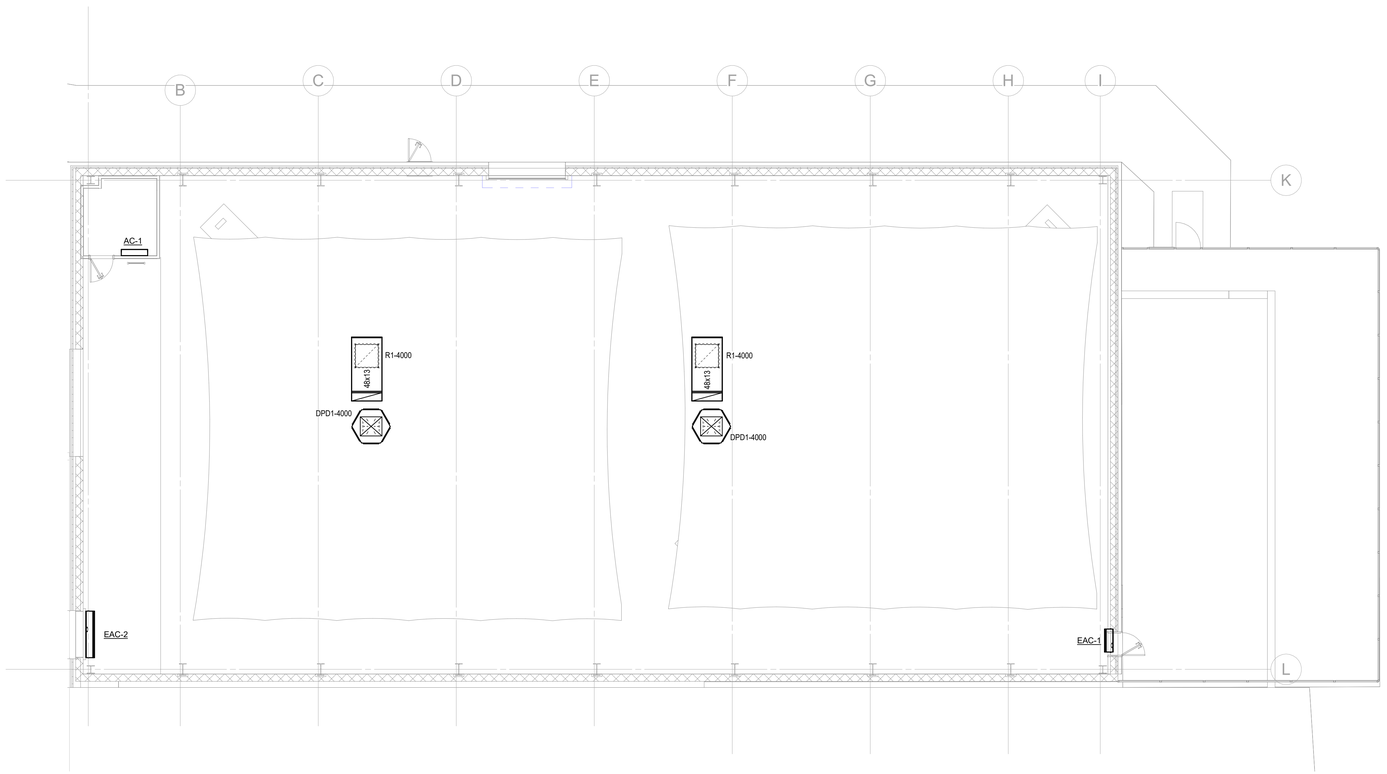

1 HOME CLUBHOUSE BATTING ARENA PLAN - MECHANICAL
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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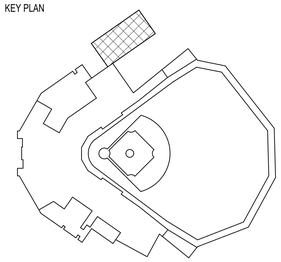

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"
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HOME CLUBHOUSE BATTING ARENA PLAN - MECHANICAL

PHASE CD
DRAWING NO. M1.1.5

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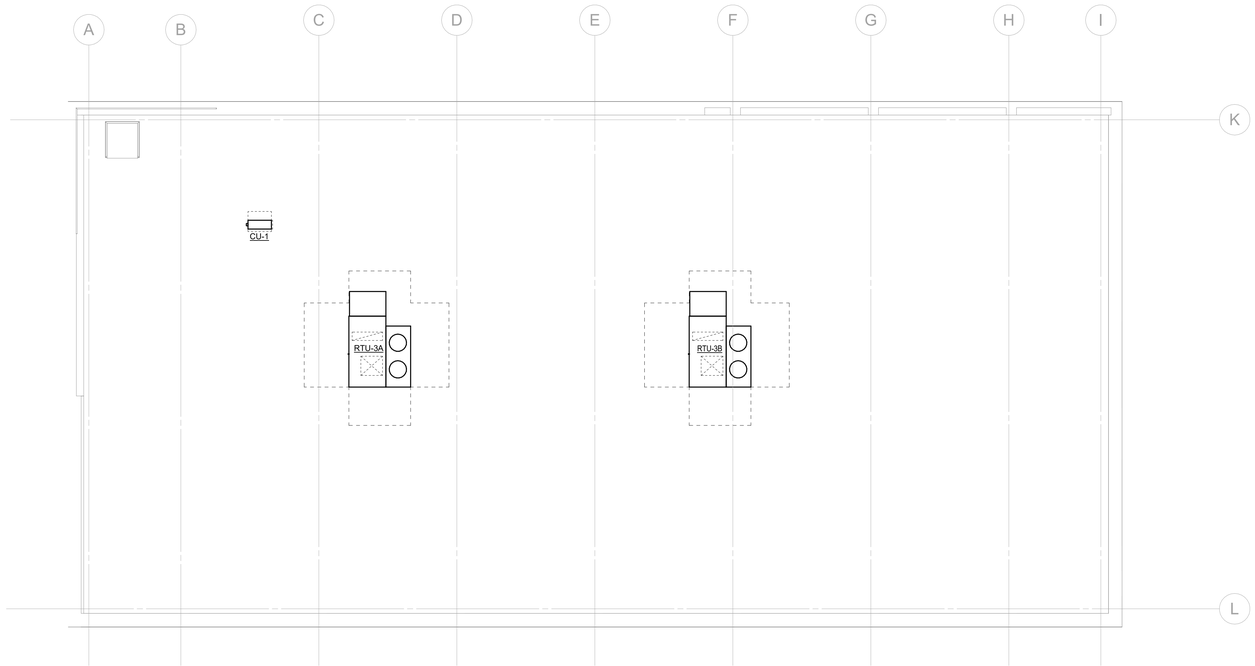

1 BATTING ARENA ROOF - MECHANICAL
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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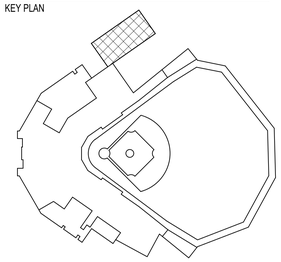

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DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE BATTING ARENA ROOF PLAN - MECHANICAL

PHASE
CD

DRAWING NO.
M1.1.6

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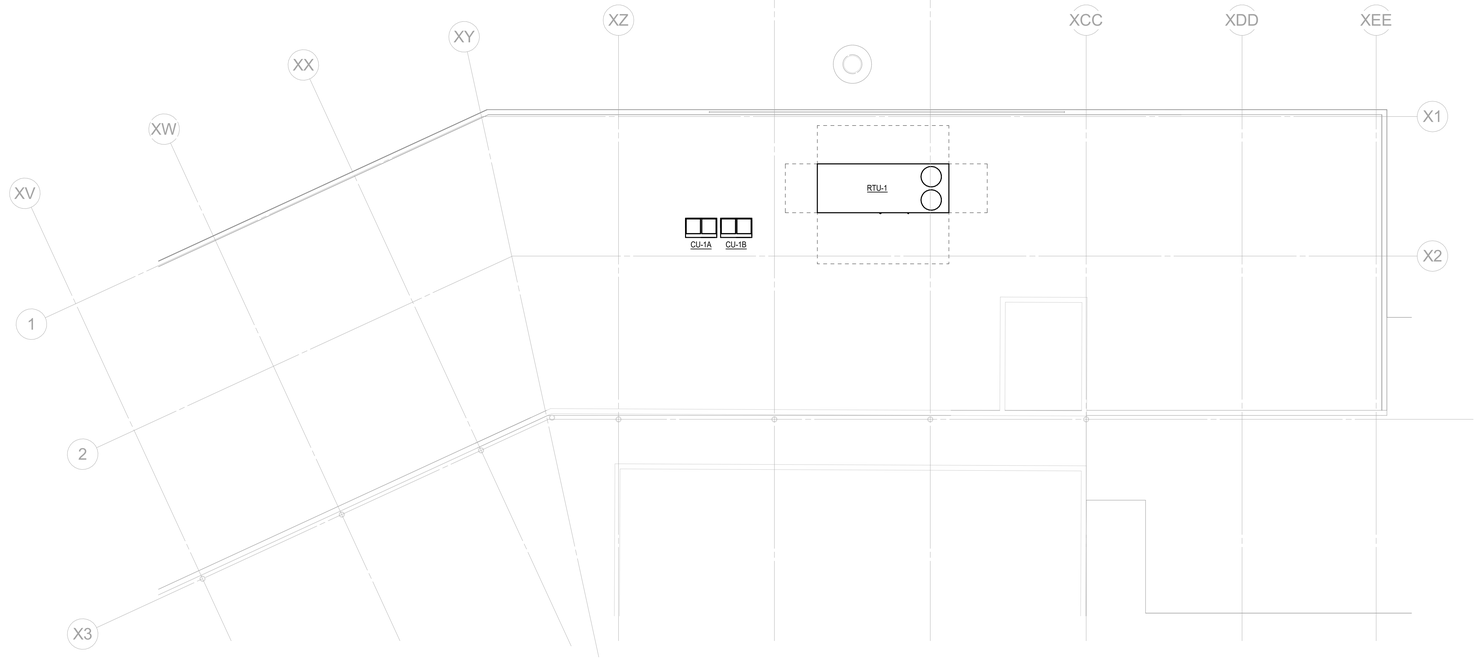
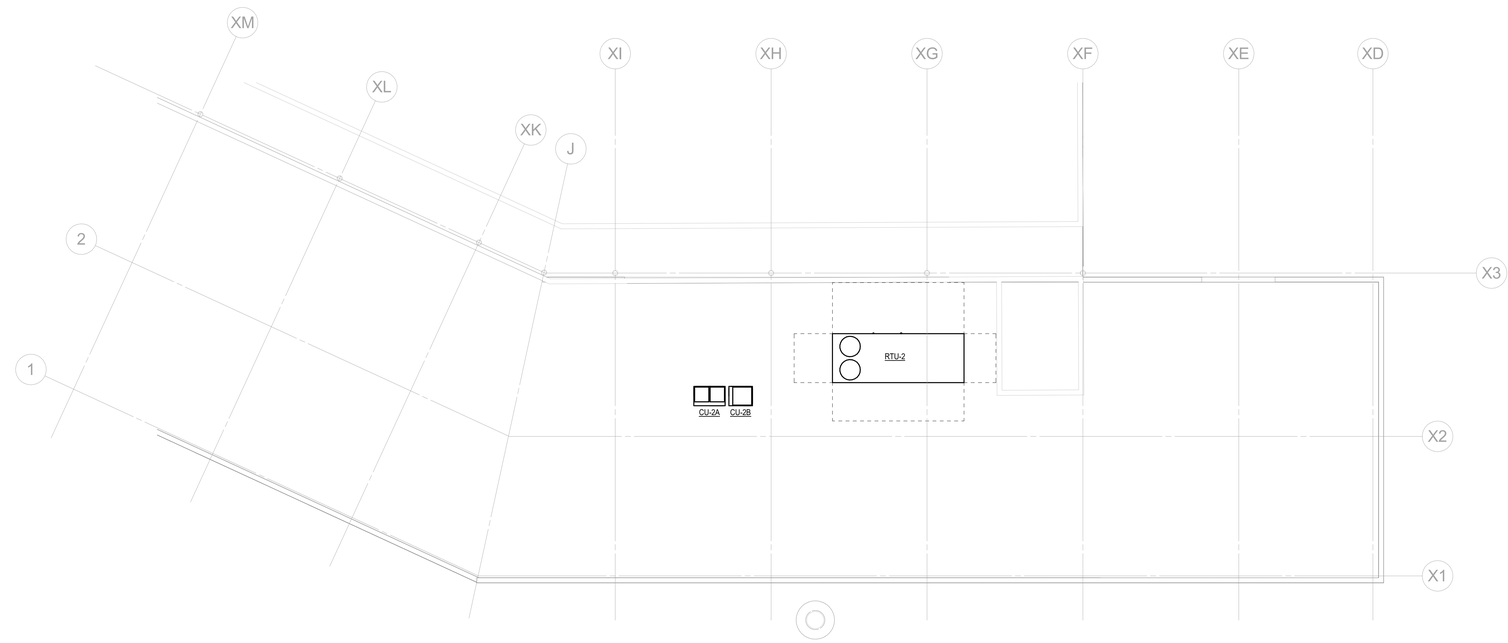


1 NEW CLUBHOUSE ROOF PLAN - HOME - MECHANICAL
SCALE: 1/8" = 1'-0"



2 NEW CLUBHOUSE ROOF PLAN - VISITOR - MECHANICAL
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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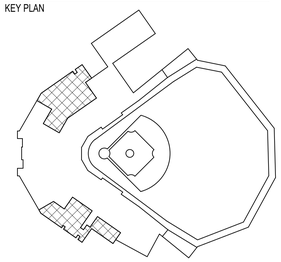
KEY PLAN



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CLUBHOUSE ROOF NEW WORK PLANS - MECHANICAL

PHASE
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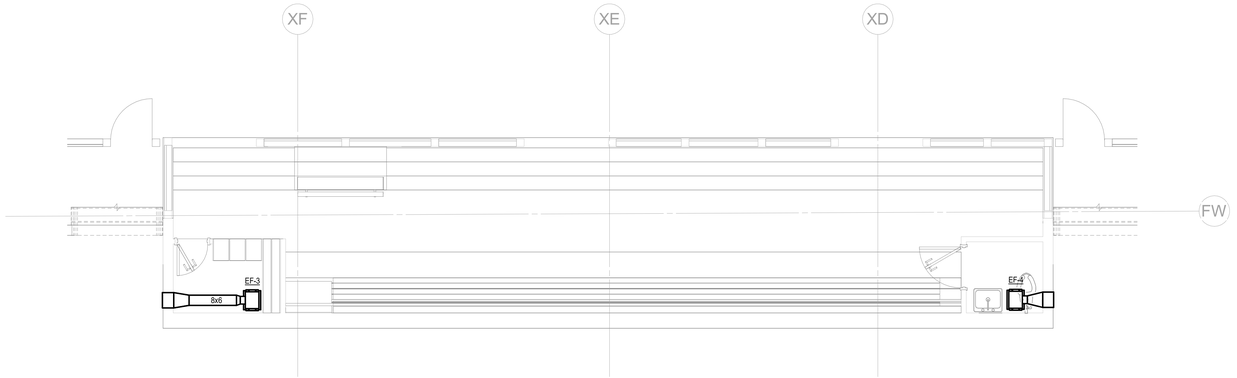
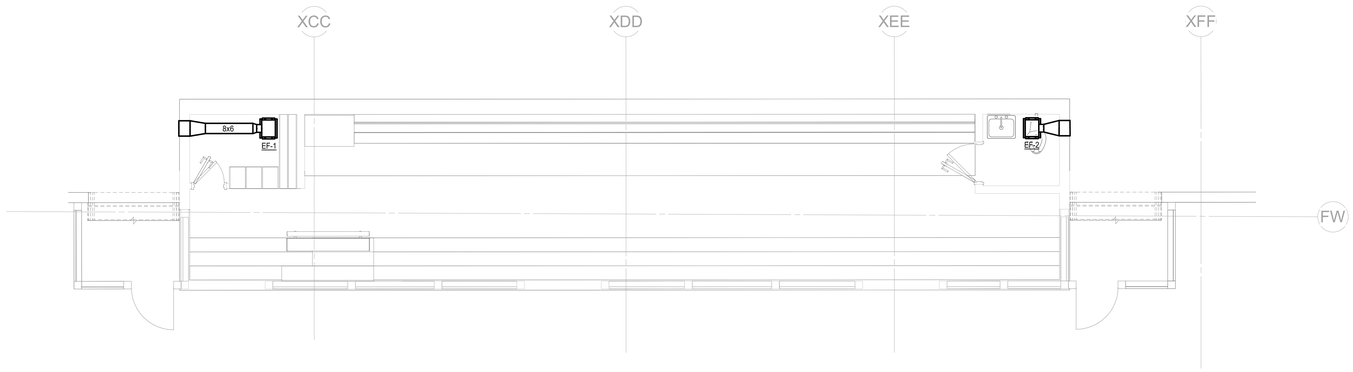


1 VISITOR DUGOUT - MECHANICAL

SCALE: 1/4" = 1'-0"



2 HOME DUGOUT - MECHANICAL

SCALE: 1/4" = 1'-0"

4' 2' 0' 4' 8'

SCALE : 1/4" = 1'-0"

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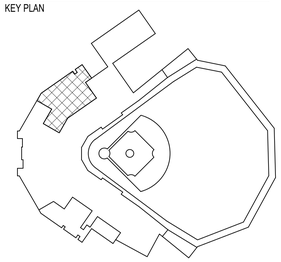

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SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME & VISITOR DUGOUT PLANS - MECHANICAL

PHASE
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M1.1.8

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HEATPUMP ROOFTOP UNIT SCHEDULE

TAG	Weight(lbs)	Qty	Model	Unit: Electrical: Voltage	Unit: Electrical: MCA (A)	Unit: Electrical: MROPD (A)	Unit: Efficiency: EER	Unit: Efficiency: SEER2 / IEER	Unit: OUTSIDE AIR: MIN	Unit: OUTSIDE AIR: MAX	Unit: Supply Fan: Airflow (CFM)	Unit: Supply Fan: ESP (in_H_2O)	Unit: Supply Fan: TSP (in_H_2O)	Unit: Supply Fan: Altitude (ft)	Unit: Supply Fan: Motor Size (HP)	Unit: Exhaust Fan: Airflow (CFM)	Unit: Exhaust Fan: ESP (in_H_2O)	Unit: Exhaust Fan: HP/MTR QTY	Unit: Filters: Face Area (ft²)	Unit: Filters: Efficiency	Energy Recovery: Recovered Capacity: Cooling (Btu/hr)	Energy Recovery: Recovered Capacity: Heating (Btu/hr)	Energy Recovery: Mixed Air LAT: Cooling (°F)	Energy Recovery: Mixed Air LAT: Heating (°F)	Energy Recovery: Effectiveness: APD (in_H_2O)	Energy Recovery: Effectiveness: Total Cooling	Energy Recovery: Effectiveness: Sensible Cooling	Energy Recovery: Effectiveness: Total Heating	Energy Recovery: Effectiveness: Sensible Heating	EAT: EDB (°F)	EAT: EWB (°F)	LAT: LDB (°F)	LAT: LWB (°F)	Cooling: Total Capacity	Cooling: Sensible Capacity	Cooling: Ambient: DB (°F)	Compressor: Stages	Compressor: Qty	Compressor: Compressor Power (kW)	Compressor: Refrigerant	Heat Pump: EAT: EDB (°F)	Heat Pump: LAT: LDB (°F)	Heat Pump: Total Capacity (Btu/hr)	Heat Pump: Ambient: DB (°F)	Electric Heating: Type	Electric Heating: Size	Electric Heating: Stages	Electric Heating: Total Capacity (Btu/hr)	Electric Heating: EDB (°F)	Electric Heating: LDB (°F)	REMARKS
RTU-1	4132	1	DPSH20B	460/60/3	137.8	150	10.9	20.3	3930	3930	3930	0.75	2.43	0	3	3930	0.75	None	27	COMBO RACK-2" MERV8 & 4" MERV14 from factory	69420	173154	84.1	45.7	0.76	44.88	53.82	57.29	59.52	84.1	72.8	54.9	53.7	235672	117746	95	with Inv	2	63.9	R32	70	128.4	244205	47	Electric	60	SCR control	204780	45.7	93.7	
RTU-2	4132	1	DPSH16B	460/60/3	123.8	125	10.8	20	3550	3550	3550	0.75	2.22	0	3	3550	0.75	None	27	COMBO RACK-2" MERV8 & 4" MERV14 from factory	65922	162345	83.6	47.1	0.68	47.1	56.98	59.43	61.83	83.6	72.6	55.2	54.3	204449	103583	95	with Inv	2	49.7	R32	70	118.4	182872	47	Electric	60	SCR control	204780	45.7	98.9	
RTU-3A	2557	1	DPSH10B	460/60/3	86.8	90	12.2	21.1	300	2000	2000	0.5	1.33	0	1.7	2000	0.5	None	18	COMBO RACK-2" MERV8 & 4" MERV14 from factory	47585	104730	81.8	52.1	0.36	61.05	67.89	69.24	70.16	81.8	71.2	52.3	51.8	117910	60810	95	with Inv	2	27.9	R32	70	120.4	107160	47	Electric	36	SCR control	122868	52.1	108.7	
RTU-3B	2557	1	DPSH10B	460/60/3	86.8	90	12.2	21.1	300	200	2000	0.5	1.33	0	1.7	2000	0.5	None	18	COMBO RACK-2" MERV8 & 4" MERV14 from factory	47585	104730	81.8	52.1	0.36	61.05	67.89	69.24	70.16	81.8	71.2	52.3	51.8	117910	60810	95	with Inv	2	27.9	R32	70	120.4	107160	47	Electric	36	SCR control	122868	52.1	108.7	

NOTES:

1. BOD: DAIKIN OR APPROVED EQUAL.
2. PROVIDE SINGLE POINT ELECTRICAL CONNECTION, HOT GAS REHEAT, DUCT MOUNTED CO2 SENSOR, LEAVING COIL/ENTERING FAN TEMPERATURE SENOR, DUCT HIGH LIMIT SWITCH, DISCHARGE AIR TEMPERARE SENSOR, OUTSIDE AIR TEMPERATURE SENSOR, DIRTY AIR FILTER SENSOR, SUPPLY LEAVING WHEEL TEMERATURE SENOR, EXHAUST LEAVING WHEEL TEMERAUTRE SENSOR, 24-INCH ROOF CURB AND MICRO-TECH III CONTROLLER. COORDINATE WITH CONTROLS ON Mxxx. PROVIDE DUCT SMOKE DETECTORS ON SUPPLY AND RETURN. REFER TO FA DRAWINGS.
3. RTU-1 AND RTU-2 SHALL INCLUDE 24" HIGH PLENUM CURB WITH 1" SOUND LINING (BY RTU MFGR). COORDINATE CONNECTIONS TO EXISTING DUCTWORK.
4. RTU-3A AND 3B SHALL INCLUDE 24" CURB (BY RTU MFGR). MFGR TO PROVIDE SCREEN WALL.
5. SEQUENCE OF OPERATION AND CONTROLS: REFER TO Mxxx.
6. INSTALL RTU IN STRICT ACCORDANCE WITH MFGR'S RECOMMENDATIONS.
7. MFGR SHALL COORDINATE COMMISSIONING REQUIREMENTS WITH CONTROLS CONTRACTOR AND COMMISSIONING ENTITY AND PROVIDE COMMISSIONING SUPPORT AS REQUIRED AND SPECIFIED.

AIR TERMINAL SCHEDULE

TAG	SERVICE	AIRFLOW RANGE (CFM)	NECK DIA (IN)	FACE SIZE (IN)	LINEAR DATA: QTY OF SLOT	LINEAR DATA: SLOT WIDTH (IN)	LINEAR DATA: SLOT LENGTH (IN)	LINEAR DATA: BAR WIDTH (IN)	MAX AIR PD (IN WG)	MAX NC	PATTERN	MANUFACTURER AND MODEL NUMBER	REMARKS
E1	EXHAUST GRILLE	0-150	6x6	-	-	-	-	-	0.10	30	-	TITUS 350FL	
E2	EXHAUST GRILLE	151-250	8x8	-	-	-	-	-	0.10	30	-	TITUS 350FL	
E3	EXHAUST GRILLE	251-500	12x8	-	-	-	-	-	0.10	30	-	TITUS 350FL	
R1	RETURN GRILLE	4,000	36x36	-	-	-	-	-	0.10	30	-	TITUS 350FL	
R2	RETURN GRILLE	1130	36x8	-	-	-	-	-	0.10	30		TITUS 350FL	
S1	SUPPLY DIFFUSER	0 - 230	6	24x24	-	-	-	-	0.10	30	AS INDICATED	TITUS OMNI-AA	
S2	SUPPLY DIFFUSER	231-350	8	24x24	-	-	-	-	0.10	30	AS INDICATED	TITUS OMNI-AA	
S3	SUPPLY REGISTER	0-150	6x6	-	-	-	-	-	0.10	30	-	TITUS 300FL	
S4	SUPPLY REGISTER	151 - 250	8x8	-	-	-	-	-	0.10	30	-	TITUS 300FL	
S5	SUPPLY REGISTER	1130	36x8	-	-	-	-	-	0.10	30	-	TITUS 300FL	

SPLIT SYSTEM AC UNIT SCHEDULE

TAG	ROOM	BASIS OF DESIGN (DAIKIN)	NOMINAL TONNAGE	TYPE	CONNECTED TO: CONDENSING UNIT	SUPPLY FAN: AIR FLOW RATE (HH/H/M/L/SL) (cfm)	COOLING CAPACITY: TOTAL (BTU/h)	COOLING CAPACITY: SENSIBLE (BTU/h)	COOLING CAPACITY: ENTERING AIR °F DB	COOLING CAPACITY: ENTERING AIR °F WB	ELECTRICAL (Comes from CU-SB-01): POWER SUPPLY Voltage - Phase	ELECTRICAL (Comes from CU-SB-01): Min Circuit Amps MCA	ELECTRICAL (Comes from CU-SB-01): Max Overcurrent Protection MOP	DIMENSIONS: WxHxD inch	WEIGHT: Net lbs	REMARKS
AC-1	IT Room	FTK24BXVJU	2	2-Ton OTERRA Wall mounted	CU-SB-01	754/716/605/467/395	24,000	16,800	80	67	-	-	-	39.5 X 11.7 X 11.3	31	

NOTES:
1. PROVIDE INTERNAL CONDENSATE PUMP KIT (BY MFGR). ROUTE PIPING TO STORM PER MFGR REQUIREMENTS.

SPLIT SYSTEM CONDENSING UNIT SCHEDULE

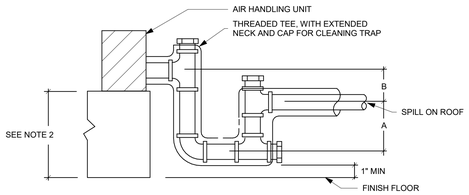
TAG	BASIS OF DESIGN (DAIKIN)	NOMINAL TONNAGE	DESCRIPTION	COOLING CAPACITY: BTU/h	COOLING CAPACITY: AMBIENT DESIGN (°F DB)	REFRIGERANT CHARGE: Factory Charge (lbs)	REFRIGERANT CHARGE: Pre-charge piping length (ft)	REFRIGERANT CHARGE: Add'l Refrigerant (lbs/ft)	ELECTRICAL: VOLTAGE-PHASE	ELECTRICAL: MIN CIRCUIT AMPS (MCA)	ELECTRICAL: MAX OVERCURRENT PROTECTION (MOP)	DIMENSIONS: (WxHxD) (inch)	DIMENSIONS: WEIGHT (lbs)	EFFICIENCY: EER2	EFFICIENCY: SEER2	REMARKS
CU-1	RK24BXVJU	2	Cooling Only Split	24,000	95	3.86	33	0.21	208-230V 1ph	13.55	20	36.7 X 27.4 X 13.8	60	12.2	20	

ELECTRIC AIR CURTAIN SCHEDULE

TAG	DOOR: WIDTH	DOOR: HEIGHT	UNIT WIDTH	TEMP RISE (DEG F)	KW	QTY OF MOTORS	QTY OF CIRCUITS	VOLTS/PH/HZ	AMPS PER CIRCUIT	MOCP	BASIS OF DESIGN	MODEL NO	REMARKS
EAC-1	36"	84"	36"	23 F	7.5	1	1	480/3/60	9.9	15	BERNER	CLC08-1036E	-
EAC-2	72"	84"	72"	23 F	15.0	1	1	480/3/60	18.9	25	BERNER	CLC08-1072E	-

FAN SCHEDULE

TAG	LOCATION	AIR CAPACITY: MAX (CFM)	AIR CAPACITY: MIN (CFM)	ESP (IN WG)	FAN RPM	VOLUME CONTROL	MOTOR: HP (WATTS)	MOTOR: VOLT	MOTOR: PH	BASIS OF DESIGN MANUFACTURER AND MODEL NUMBER	REMARKS
EF-1	DUGOUT	110	110	0.25	960	NO	12W	120	1	GREENHECK SP-A90-130-VG	WALL SWITCH
EF-2	DUGOUT	110	110	0.25	960	NO	12W	120	1	GREENHECK SP-A90-130-VG	WALL SWITCH
EF-3	DUGOUT	110	110	0.25	960	NO	12W	120	1	GREENHECK SP-A90-130-VG	WALL SWITCH
EF-4	DUGOUT	110	110	0.25	960	NO	12W	120	1	GREENHECK SP-A90-130-VG	WALL SWITCH

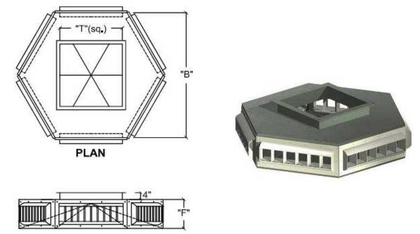


BLOWTHRU:
A = GREATER OF 4" OR 1/2" PLUS AHU TOTAL PRESSURE IN INCHES-WC

DRAWTHRU:
B = GREATER OF 2" OR 1/2" PLUS AHU TOTAL PRESSURE IN INCHES-WC

NOTES:
1 1"∅ MIN PIPE SIZE OR SIZE PER DRAIN TAP IN AHU INSULATE FOR CONDENSATE CONDENSATE CONTROL AS REQD
2 CURB HEIGHT DETERMINED BY SPACE REQD TO INSTALL TRAP

2 CONDENSATE DRAIN TRAP DETAIL
NOT TO SCALE



DROP PLENUM DRUM DIFFUSER SCHEDULE

TAG	"T" (SQ)	"B"	"F"	GRILLE SIZE	NOM CFM	NOM THROW	NOM N.C.	VP (IN WG)	BASIS OF DESIGN	MODEL
DPD-1	20"	35"	9"	12"x6"	2,000	29-35-50	38	0.05	UNITED ENERTECH	DPD6-5T
-	-	-	-	-	-	-	-	-	-	-

NOTES:
1. PROVIDE TDC DUCT CONNECTION AND TURNING VANES.
2. G90 GALVANIZED STEEL CONSTRUCTION PER SMACNA DUCT CONSTRUCTION STANDARDS.

1 DROP PLENUM DRUM DIFFUSER DETAIL
NOT TO SCALE

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	WFT	ISSUE 4: CONSTRUCTION DOCUMENTS	6/21/24
B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE NOT TO SCALE

DRAWING NAME

MECHANICAL SCHEDULES

PHASE CD

DRAWING NO. M7.1.1

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VARIABLE REFRIGERANT VOLUME - AIR-COOLED CONDENSING UNIT SCHEDULE

TAG: ROOM	BASIS OF DESIGN (DAIKIN)	NOMINAL TONNAGE	DESCRIPTION	COOLING CAPACITY		HEATING CAPACITY		REFRIGERANT CHARGE		CONNECTION RATIO (%)	ELECTRICAL												DIMENSIONS	WEIGHT	EFFICIENCY (NonDucted/Ducted or Specific Combo)							Options and Accessories
				BTU/h	AMBIENT DESIGN (°F DB)	BTU/h	AMBIENT DESIGN (°F DB / WB)	Factory Charge (lbs)	Add'l Refrigerant (lbs)		VOLTAGE-PHASE	MIN CIRCUIT AMPS (MCA)				MAX OVERCURRENT PROTECTION (MOP)				RUNNING CURRENT(RLA)				(WxHxD) (inch)		EER	IEER	COP47	COP17	SCHE	SEER	HSPF	
												mod #1	mod #2	mod #3	total	mod #1	mod #2	mod #3	total	mod #1	mod #2	mod #3	total									
CU- 1	RXYQ240XAYDA	20	Air cooled heat pump (2)	192,216	95.0	164,822	10.0 / 9.0	45.9	43.1	109.2	460V 3ph	20.6	20.6		41.2	25.0	25.0		50.0	11.7	11.7		23.4	48.9 x 66.7 x 30.2 / 48.9 x 66.7 x 30.2	555.6 / 555.6	11.3 / 11.2	20.8 / 20.9	3.63 / 3.33	2.43 / 2.34	n/a	n/a / n/a	n/a / n/a	BHFP22P100UA (1)
CU- 2	RXYQ192XAYDA	16	Air cooled heat pump (2)	140,951	95.0	139,134	10.0 / 9.0	35.9	21.4	103.6	460V 3ph	20.6	12.3		32.9	25.0	20.0		45.0	11.7	7.1		18.8	48.9 x 66.7 x 30.2 / 36.7 x 66.7 x 30.2	555.6 / 451.9	11.5 / 11.6	22.2 / 21.2	3.68 / 3.29	2.27 / 2.23	n/a	n/a / n/a	n/a / n/a	BHFP22P100UA (1)

Refrigerant Piping

Pipe Size	Total Length	Number of Bends
1/4	585.0	136
3/8	195.0	60
1/2	660.0	172
5/8	265.0	70
3/4	150.0	34
7/8	30.0	20
1	20.0	8
1 1/8	85.0	30
1 1/4	80.0	20
1 3/8	60.0	10

VRV Material List

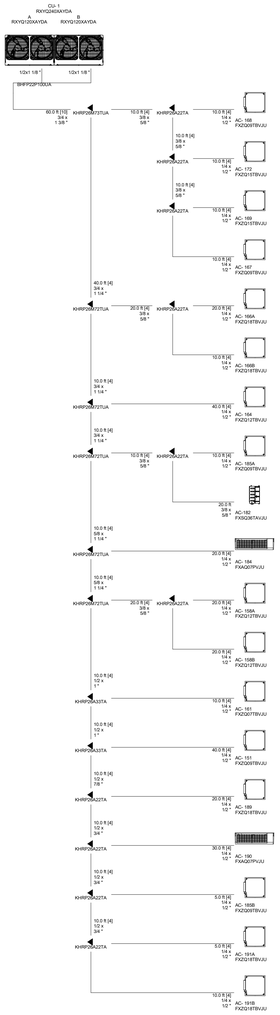
Model	Qty	Description
RXYQ72XAYDA	1	VRV-IV-X -A (460V)
RXYQ120XAYDA	3	VRV-IV-X -A (460V)
FXAQ07PVJU	2	FXAQ - Wall Mounted Unit
FXSQ36TAVJU	1	FXSQ - MSP Concealed Ducted Unit
FXZQ07TBVJU	2	FXZQ_TBVJU - 4-Way Discharge Ceiling Cassette Vista (2' x 2') white
FXZQ09TBVJU	10	FXZQ_TBVJU - 4-Way Discharge Ceiling Cassette Vista (2' x 2') white
FXZQ12TBVJU	9	FXZQ_TBVJU - 4-Way Discharge Ceiling Cassette Vista (2' x 2') white
FXZQ15TBVJU	2	FXZQ_TBVJU - 4-Way Discharge Ceiling Cassette Vista (2' x 2') white
FXZQ18TBVJU	9	FXZQ_TBVJU - 4-Way Discharge Ceiling Cassette Vista (2' x 2') white
KHRP26A22TA	15	Refnet branch piping kit
KHRP26A33TA	6	Refnet branch piping kit
KHRP26M72TUA	11	Refnet branch piping kit
KHRP26M73TUA	1	Refnet branch piping kit
BHFP22P100UA	2	Dual Module Multi Connection Piping Kit - Heat Pump
BRC1E73	35	new Navigation Remote Controller
BYFQ60C3W2W	32	Decoration Panel White
R410A	64.5	Extra refrigerant charge (lbs)

VRV SYSTEM NOTES:

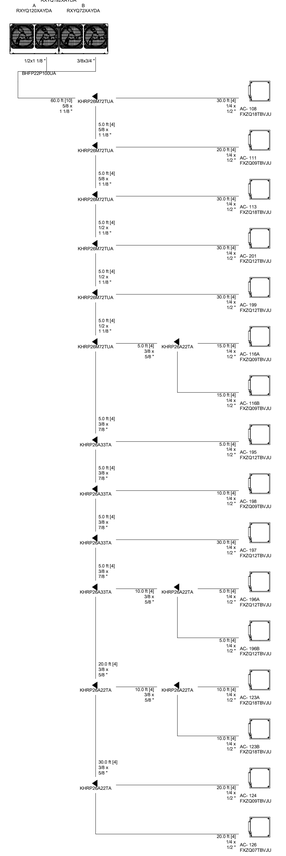
1. MANUFACTURER SHALL BE CERTIFIED, LISTED, AND LABELED PER AHRI 1230.
2. SYSTEM RATING DATA BASED ON DESIGN AMBIENT CONDITIONS FOR COOLING AND FOR HEATING.
3. SUBMITTED PERFORMANCE DATA SHALL BE FULLY DE-RATED FOR ALL COMPONENTS AND ACCESSORIES, INCLUDING BUT NOT LIMITED TO, LINE LENGTH, VERTICAL SEPARATION, CONNECTION RATIO, DESIGN CONDITIONS, CONDENSER COIL COATING.
4. CONDENSING UNITS SHALL HAVE FULLY MODULATING INVERTER COMPRESSORS.
5. CONDENSING UNITS SHALL HAVE HAVE AUTO CHANGEOVER FUNCTIONS
6. DEMAND LIMITING RELAY CONTACTS SHALL BE PROVIDED.
7. EEV ACTUATORS SHALL BE REMOVABLE FROM VALVE BODY WITHOUT DISTURBING THE REFRIGERANT SYSTEM.
8. FCU THERMOSTATS SHALL PROVIDE +/- 1 DEGREE DEAD-BAND SET-POINT AND CONTROL CAPABILITY.
9. SYSTEM SHALL BE PROVIDED WITH TOUCH MANAGER CONTROLLER WITH WEB BASED SOFTWARE FOR DISPLAYING UP TO 8 DIII-NET SYSTEMS WITH 128 INDOOR UNITS PER SYSTEM.PC BY OTHERS.
10. MANUFACTURERS SUBMITTAL SHALL INCLUDE REFRIGERANT PIPING DIAGRAM WITH PIPE DIAMETERS, LENGTHS, AND REFRIGERANT VOLUME.
11. SUBSTITUTE MANUFACTURER SHALL BE RESPONSIBLE FOR ADDITIONAL PIPING AND REFRIGERANT.
12. CONTRACTOR TO VERIFY PIPING DIMENSIONS.
13. INSTALLING CONTRACTOR SHALL HAVE SUCCESSFULLY COMPLETED MANUFACTURERS CERTIFIED INSTALLATION CLASS WITHIN PAST 36 MONTHS.
14. CONTRACTOR TO FURNISH AND INSTALL INSULATION ON REFRIGERANT PIPING.
15. MANUFACTURER'S REPRESENTATIVE SHALL HAVE LOCAL STOCK OF PARTS AND FACTORY CERTIFIED TECHNICIAN ON STAFF.
16. MANUFACTURER'S REPRESENTATIVE SHALL PROVIDE PROOF OF ONGOING INSTALLATION TRAINING AT THEIR LOCAL FACILITY FOR AT LEAST THE PAST 5 YEARS.
17. MANUFACTURER'S REPRESENTATIVE SHALL PROVIDE PROOF OF CONTINUOUS SALES AND SUPPORT OF THEIR PRODUCTS FOR AT LEAST 15 YEARS.
18. MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DIRECT COSTS AND OPERATING COSTS INCREASES FOR 20 YEARS ASSOCIATED WITH ANY DEVIATIONS RESULTING FROM CHANGES IN DESIGN.
19. MANUFACTURER SHALL PROVIDE 10 YEARS PARTS WARRANTY ON ALL FCUS, CONDENSING UNITS, AND MODE CHANGEOVER DEVICES. WARRANTY CONDITIONS SHALL BE CLARIFIED DURING SUBMITTAL PHASE.
20. 3-PHASE AIR COOLED CONDENSING UNITS SHALL HAVE PUBLISHED PERFORMANCE DATA WITH 200% INDOOR CONNECTED CAPACITY.
21. "CONDENSING UNITS SHALL BE FURNISHED WITH PROTECTIVE COIL COATING TO WITHSTAND ASTM B117 SALT SPRAY TEST FOR A MINIMUM OF 1000 HOURS.
22. PERFORMANCE OF SYSTEM SHALL BE DE-RATED FOR COIL COATING."
23. MANUFACTURER SHALL CERTIFY AND SUBMIT SYSTEM PERFORMANCE AT EXTREME CONDITIONS OF 122 DEGREES FDB AMBIENT IN COOLING MODE AND -4 DEGREES FWB IN HEATING MODE.
24. MANUFACTURER SHALL PROVIDE 10 YEARS PARTS WARRANTY ON ALL FCUS AND CONDENSING UNITS. WARRANTY CONDITIONS SHALL BE CLARIFIED DURING SUBMITTAL PHASE.

VARIABLE REFRIGERANT VOLUME - INDOOR UNIT SCHEDULE

TAG	ROOM	BASIS OF DESIGN (DAIKIN)	NOMINAL TONNAGE	TYPE	CONNECTED TO:		SUPPLY FAN	COOLING CAPACITY			HEATING CAPACITY		ELECTRICAL			DIMENSIONS	WEIGHT	NOTES	Options and Accessories
					CONDENSING UNIT	ZONE CHANGEOVER DEVICE	AIR FLOW RATE cfm	TOTAL BTU/h	SENSIBLE BTU/h	ENTERING AIR °F DB	ENTERING AIR °F WB	TOTAL BTU/h	ENTERING AIR °Fdb	POWER SUPPLY Voltage - Phase	Min Circuit Amps MCA	Max Overcurrent Protection MOP	WxHxD inch	Net lbs		
AC- 168		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 172		FXZQ15TBVJU	1.3	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	405	13,040	9,305	75.0	63.0	17,690	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 169		FXZQ15TBVJU	1.3	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	405	13,040	9,305	75.0	63.0	17,690	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 167		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 166A		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 166B		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 164		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 185A		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC-182		FXSQ36TAVJU	3.0	MSP Concealed Ducted Unit	CU-1	No	1,130	31,590	22,668	75.0	63.0	41,163	68.0	208-230V 1ph	2.5	15.0	55.1 x 9.6 x 31.5	101.0		BRC1E73 (1)
AC- 184		FXAQ07PVJU	0.6	Wall Mounted Unit	CU-1	No	260	6,414	5,424	75.0	63.0	8,674	68.0	208-230V 1ph	0.3	15.0	31.3 x 11.4 x 9.3	26.5		BRC1E73 (1)
AC- 158A		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 158B		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 161		FXZQ07TBVJU	0.6	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	307	6,577	5,117	75.0	63.0	8,845	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 151		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 189		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 190		FXAQ07PVJU	0.6	Wall Mounted Unit	CU-1	No	260	6,414	5,424	75.0	63.0	8,674	68.0	208-230V 1ph	0.3	15.0	31.3 x 11.4 x 9.3	26.5		BRC1E73 (1)
AC- 185B		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 191A		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-1	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 191B		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 108		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 111		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 113		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 201		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 199		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 116A		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 116B		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 195		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 198		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 197		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 196A		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 196B		FXZQ12TBVJU	1.0	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	353	10,432	7,016	75.0	63.0	13,948	68.0	208-230V 1ph	0.4	15.0	22.6 x 10.2 x 22.6	36.4		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 123A		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 123B		FXZQ18TBVJU	1.5	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	511	15,421	11,264	75.0	63.0	20,752	68.0	208-230V 1ph	0.6	15.0	22.6 x 10.2 x 22.6	41.9		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 124		FXZQ09TBVJU	0.8	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	317	8,164	5,806	75.0	63.0	10,886	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)
AC- 126		FXZQ07TBVJU	0.6	4-Way Discharge Ceiling Cassette Vista (2' x 2') white	CU-2	No	307	6,577	5,117	75.0	63.0	8,845	68.0	208-230V 1ph	0.3	15.0	22.6 x 10.2 x 22.6	35.3		BRC1E73 (1), BYFQ60C3W2W (1)



CU-1 PIPING DIAGRAM
NOT TO SCALE



CU-2 PIPING DIAGRAM
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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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MECHANCIAL SCHEDULES AND DIAGRAMS - VRV SYSTEM

PHASE CD
DRAWING NO. M7.1.2

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PLUMBING SPECIFICATIONS

1. ALL WORK SHALL BE IN ACCORDANCE WITH LOCAL CODES.
2. THESE DRAWINGS ARE SCHEMATIC AND INTENDED TO DEPICT THE GENERAL LOCATION OF PLUMBING SYSTEMS COMPONENTS. CONSULT ARCHITECTURAL PLANS FOR PROPER DIMENSIONS AND LOCATION OF FIXTURES.
3. PROVIDE ALL NECESSARY TRANSITIONS IN PIPING FOR COMPLETE INSTALLATION. NOT ALL OFFSETS ARE SHOWN ON THE DRAWINGS. ALL PIPING AND ACCESSORIES SHALL BE FULL SIZE AND REDUCED IN SIZE ONLY IMMEDIATELY BEFORE THE CONNECTION POINT TO THE EQUIPMENT.
4. FREE ACCESS IS REQUIRED ON ALL SIDES OF EQUIPMENT. ALL SUCH EQUIPMENT SHALL BE LOCATED AS TO PROVIDE ADEQUATE SERVICE CLEARANCE AND AS REQUIRED TO MEET THE CLEARANCES REQUIRED BY THE NATIONAL ELECTRIC CODE (NEC).
5. PLUMBING FIXTURES SHALL BE AS INDICATED ON THE FIXTURE CONNECTION SCHEDULE.
6. DOMESTIC HOT AND COLD WATER PIPING SHALL BE TYPE "L" HARD DRAWN COPPER TUBING PER ASTM B-88 AND FEDERAL SPEC. WWT-799. FITTINGS SHALL BE SOLDER JOINT COPPER FITTINGS PER B16.18 OR B16.22. JOINTS SHALL BE SOLDER TYPE CONSISTING OF 95% TIN AND 5% ANTIMONY. THE DISINFECTION OF POTABLE WATER PIPING SHALL BE PERFORMED IN ACCORDANCE WITH LOCAL REQUIREMENTS.
7. WASTE AND VENT PIPING: CAST IRON NO-HUB TYPE WITH MANUFACTURER'S STANDARD COUPLINGS OR DWV COPPER WITH SOLDER JOINT COPPER FITTINGS. PVC PIPING SHALL NOT BE USED. ALL WASTE AND VENT PIPING SHALL BE INSTALLED AS PER THE INTERNATIONAL PLUMBING CODE AND SHALL BE PITCHED TO DRAIN AT 1/4" FOR 2-1/2" OR LESS AND 1/8" FOR 3" TO 6". PIPING INSTALLED UNDERGROUND SHALL BE INSTALLED AS PER THE MANUFACTURER'S PUBLISHED RECOMMENDATIONS FOR SERVICE INDICATED.

FIXTURE CONNECTION SCHEDULE

ITEM No	DESCRIPTION	MANUFACTURER	CW	HW	WASTE	VENT	REMARKS
SK-1	SINK/FAUCET	CORIAN DESIGN 5610	1/2"	1/2"	2"	1-1/2"	UNDERMOUNT, SINGLE BOWL FAUCET: AMERICAN STANDARD 6403.170, 1.5 GPM
GD-1	GARBAGE DISPOSAL	IN SINK ERATOR BADGER 5	-	-	-	-	1/2 H.P.
LAV-1	SINK/FAUCET	CORIAN DESIGN 810P	1/2"	1/2"	1-1/2"	1-1/2"	OVAL, UNDERMOUNT FAUCET : ZURNZ6955-XL-S-F-TMV-1, 1/2 GPM FLOW RESTRICTOR, BATTERY POWERED
LAV-2	SINK/FAUCET	ZURN Z5344	1/2"	1/2"	1-1/2"	1-1/2"	WALL HUNG, VITREOUS CHINA FAUCET : ZURNZ6955-XL-S-F-TMV-1, 1/2 GPM FLOW RESTRICTOR, BATTERY POWERED
WC-1	WATER CLOSET	ZURN Z5615-BWL	1"	-	4"	2"	WALL HUNG, VITREOUS CHINA, ELONGATED BOWL FLUSH VALVE: ZURN ZER600AV-HET-CPM, BATTERY POWERED, 1.28 GPM
WC-2	WATER CLOSET ADA	ZURN Z5615-BWL	1"	-	4"	2"	WALL HUNG, VITREOUS CHINA, HANDICAPPED HEIGHT FLUSH VALVE: ZURN ZER600AV-HET-CPM, BATTERY POWERED, 1.28 GPM
UR-1	URINAL	ZURN Z5755-U	1/2"	-	2"	1-1/2"	WALL HUNG, VITREOUS CHINA FLUSH VALVE: ZURN ZER6003AV-EWS-CPM
MS-1	MOP SINK/FAUCET	FIAT TSBC	1/2"	1/2"	2"	1-1/2"	24 x 24, PRECAST TERRAZZO FAUCET: T&S BRASS CO. B-0665-BSTP
SH-1	SHOWER	AQUARIUS MODEL G 2682 BF RRF	1/2"	1/2"	2"	1-1/2"	36 x 36 x 84, CAST ACRYLIC SHEET ONE PIECE SHOWER HEAD: STANDARD TYPE, RIGID ARM, BALL JOINT CONTROL: THERMOSTATIC/PRESSURE BALANCED, POWERS e707G10000
SH-2	SHOWER ADA	AQUARIUS MODEL G 2682 BF RRF	1/2"	1/2"	2"	1-1/2"	36 x 36 x 84, CAST ACRYLIC SHEET ONE PIECE, TEAKWOOD FOLD-UP TRANSFER SEAT SHOWER HEAD: STANDARD TYPE, RIGID ARM, BALL JOINT CONTROL: THERMOSTATIC/PRESSURE BALANCED, POWERS e707G10000
FD-1	FLOOR DRAIN	ZURN Z415 W/TYPE B STRAINER	-	-	3"	2"	PROVIDE RECTORSEAL SURE SEAL XXXXX DRAIN TRAP SEAL
DW-1	DISHWASHER	-	-	-	3"	2"	PROVIDE RECTORSEAL SURE SEAL XXXXX DRAIN TRAP SEAL
IM-1	ICE MACHINE	-	-	-	3"	2"	PROVIDE RECTORSEAL SURE SEAL XXXXX DRAIN TRAP SEAL
IM-2	ICE MACHINE	-	-	-	3"	2"	PROVIDE RECTORSEAL SURE SEAL XXXXX DRAIN TRAP SEAL

NOTES:
1. PROVIDE STOP VALVES AT ALL FIXTURES.
2. PROVIDE ALL NECESSARY ITEMS TO COMPLETE INSTALLATION.
3. ALL EQUIPMENT SHALL BE INSTALLED PER MANUFACTURER REQUIREMENTS.

PLUMBING SYMBOLS

- COLD WATER PIPING
- HOT WATER PIPING
- VENT PIPING
- SANITARY PIPING
- PIPE TURNING DOWN
- PIPE TURNING UP
- PIPE CONTINUING
- PLUMBING NOTE DESIGNATION
- NEW TO EXISTING DESIGNATION
- LIMIT OF DEMOLITION
- BALL VALVE
- BACKFLOW PREVENTER

PLUMBING ABBREVIATIONS

BFP	BACKFLOW PREVENTER
CM	COFFEE MAKER
CW	COLD WATER
DW	DISHWASHER
(E)	EXISTING
F	FILTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
GD	GARBAGE DISPOSAL
HW	HOT WATER
LAV	LAVATORY
REF	REFRIGERATOR
SAN	SANITARY
SH	SHOWER
SK	SINK
TYP	TYPICAL
UR	URINAL
V	VENT
WC	WATER CLOSET

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DRAWING NAME
SYMBOLS, ABBREVIATIONS AND NOTES

PHASE
CD

DRAWING NO.
P0.01

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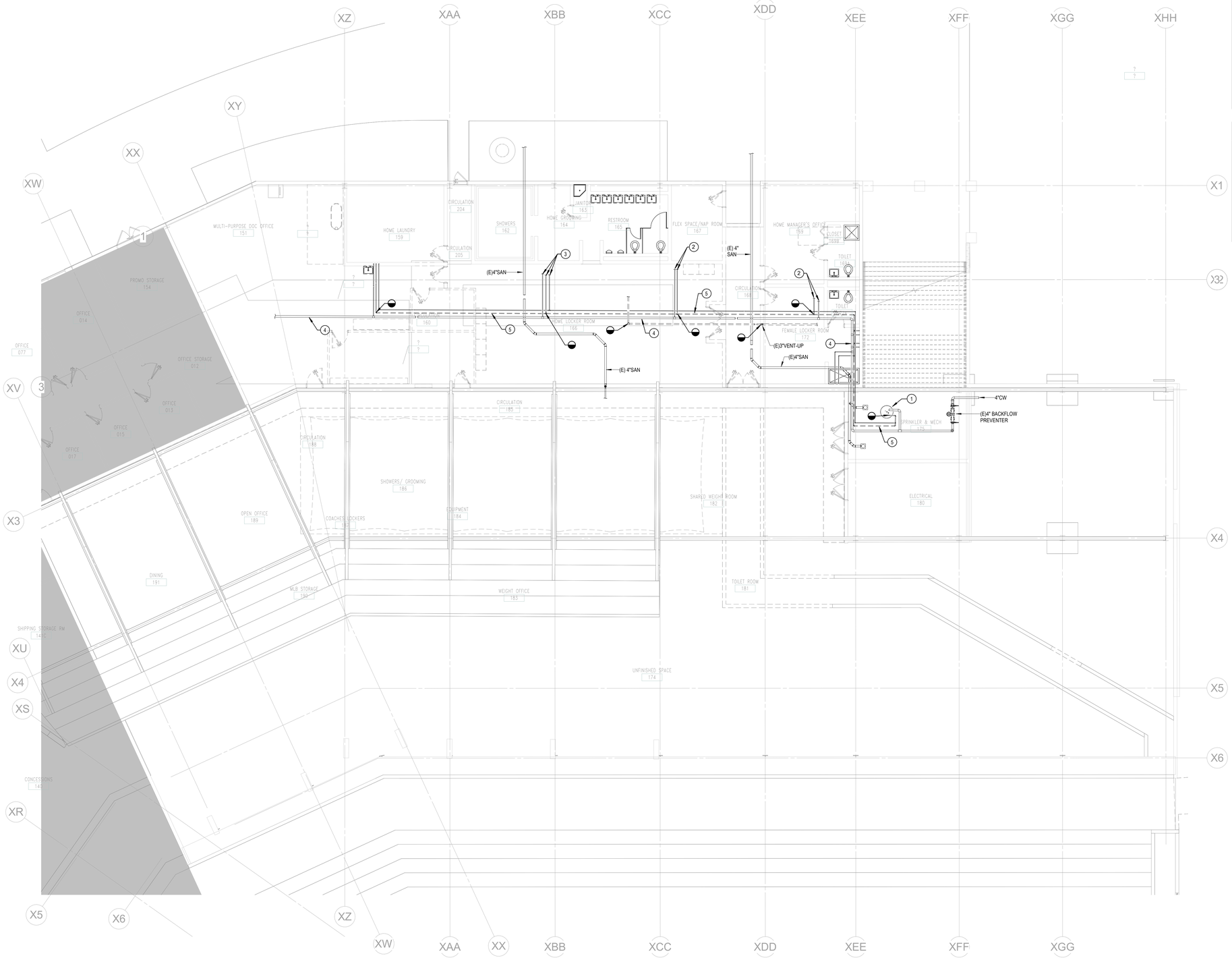

GENERAL NOTES

1. EVERY EFFORT HAS BEEN MADE TO INDICATE ALL PIPING AND EQUIPMENT THAT IS BEING REMOVED THROUGH EXISTING DRAWINGS AND FIELD OBSERVATIONS. HOWEVER, THE CONTRACTOR IS TO VERIFY ALL REMOVALS. SOME DIFFERENCES MAY OCCUR.

2. ALL PIPING IS SHOWN DIAGRAMMATICALLY. ALL WORK SHOWN BOLD AND/OR DASHED IS CONSIDERED TO BE DEMOLISHED UNDER THIS CONTRACT UNLESS NOTED OTHERWISE. CONTRACTOR TO VERIFY SIZES AND LOCATION OF EXISTING PIPING.

3. COORDINATE SCOPE OF WORK WITH ARCHITECTURAL DRAWINGS.

4. PATCH AND/OR REPAIR ALL SLAB OR RATED PARTITION OPENINGS IMMEDIATELY WHERE PIPES AND/OR PLUMBING FIXTURES HAVE BEEN REMOVED AS REQUIRED.

DEMOLITION NOTES

1. EXISTING WATER HEATER TO REMAIN.
2. EXISTING HOT WATER AND COLD WATER TO REMAIN.
3. EXISTING HOT WATER, COLD WATER AND HOT WATER RETURN TO REMAIN.
4. EXISTING COLD WATER PIPING TO REMAIN.
5. REMOVE EXISTING HOT WATER PIPING.

1 HOME CLUBHOUSE DEMO PLAN - PLUMBING

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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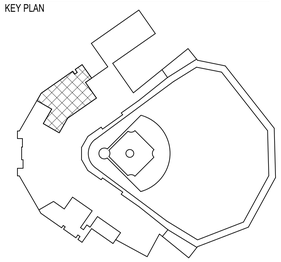

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HOME CLUBHOUSE - DEMO PLAN - PLUMBING

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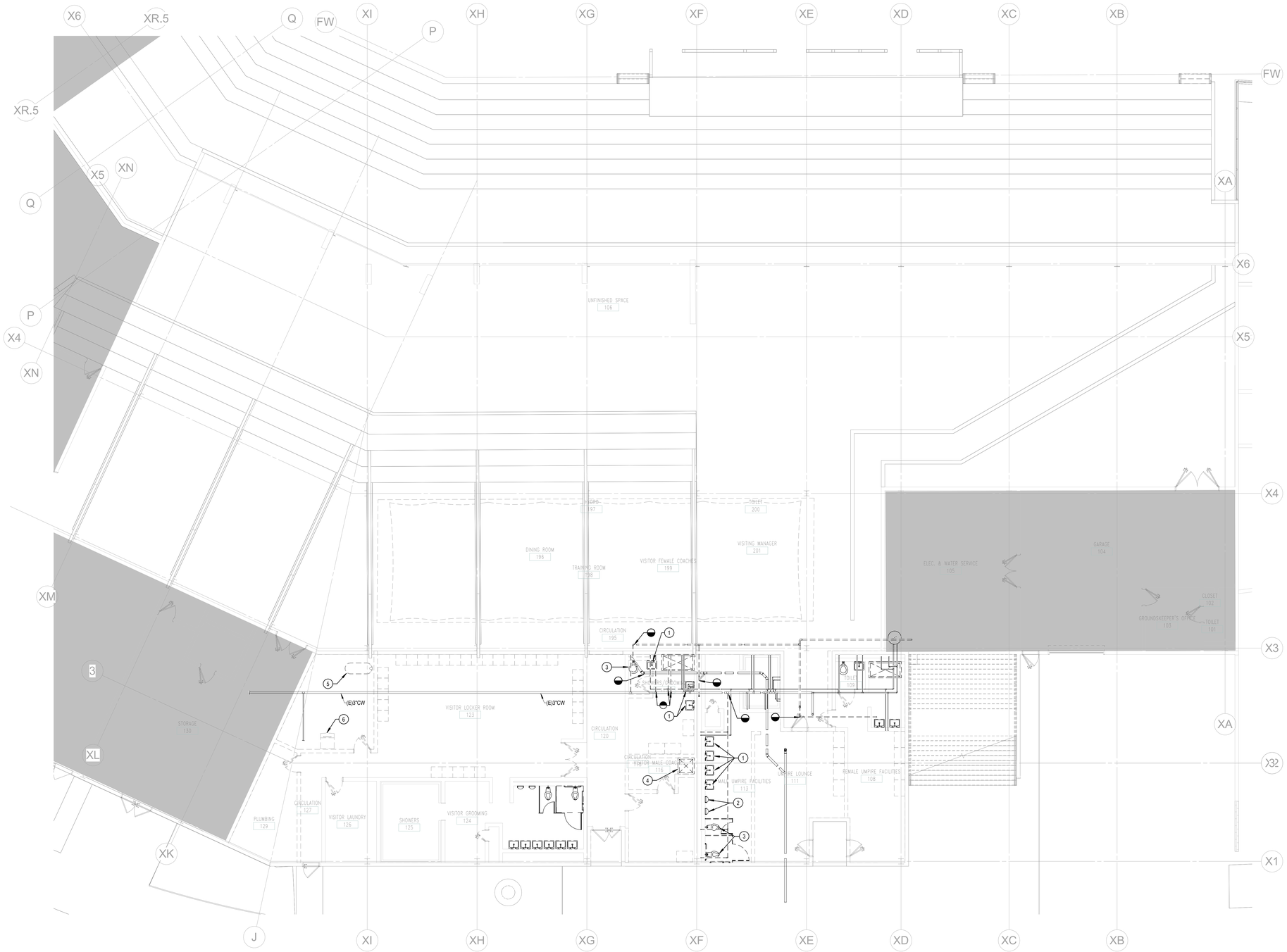

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3. COORDINATE SCOPE OF WORK WITH ARCHITECTURAL DRAWINGS.

4. PATCH AND/OR REPAIR ALL SLAB OR RATED PARTITION OPENINGS IMMEDIATELY WHERE PIPES AND/OR PLUMBING FIXTURES HAVE BEEN REMOVED AS REQUIRED.

DEMOLITION NOTES

1. REMOVE EXISTING LAVATORY AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.
2. REMOVE EXISTING URINAL AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.
3. REMOVE EXISTING WATER CLOSET AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.
4. REMOVE EXISTING SHOWER AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.
5. REMOVE EXISTING WHIRLPOOL AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.
6. REMOVE EXISTING ICE MACHINE AND ALL ASSOCIATED PIPING AND APPURTENANCES. CAP PIPING BACK TO ACTIVE MAINS.

1 VISITOR CLUBHOUSE DEMO PLAN - PLUMBING

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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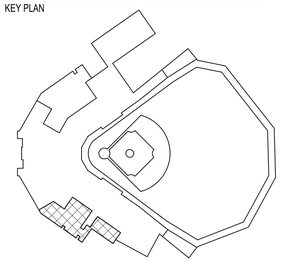

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VISITOR CLUBHOUSE - DEMO PLAN - PLUMBING

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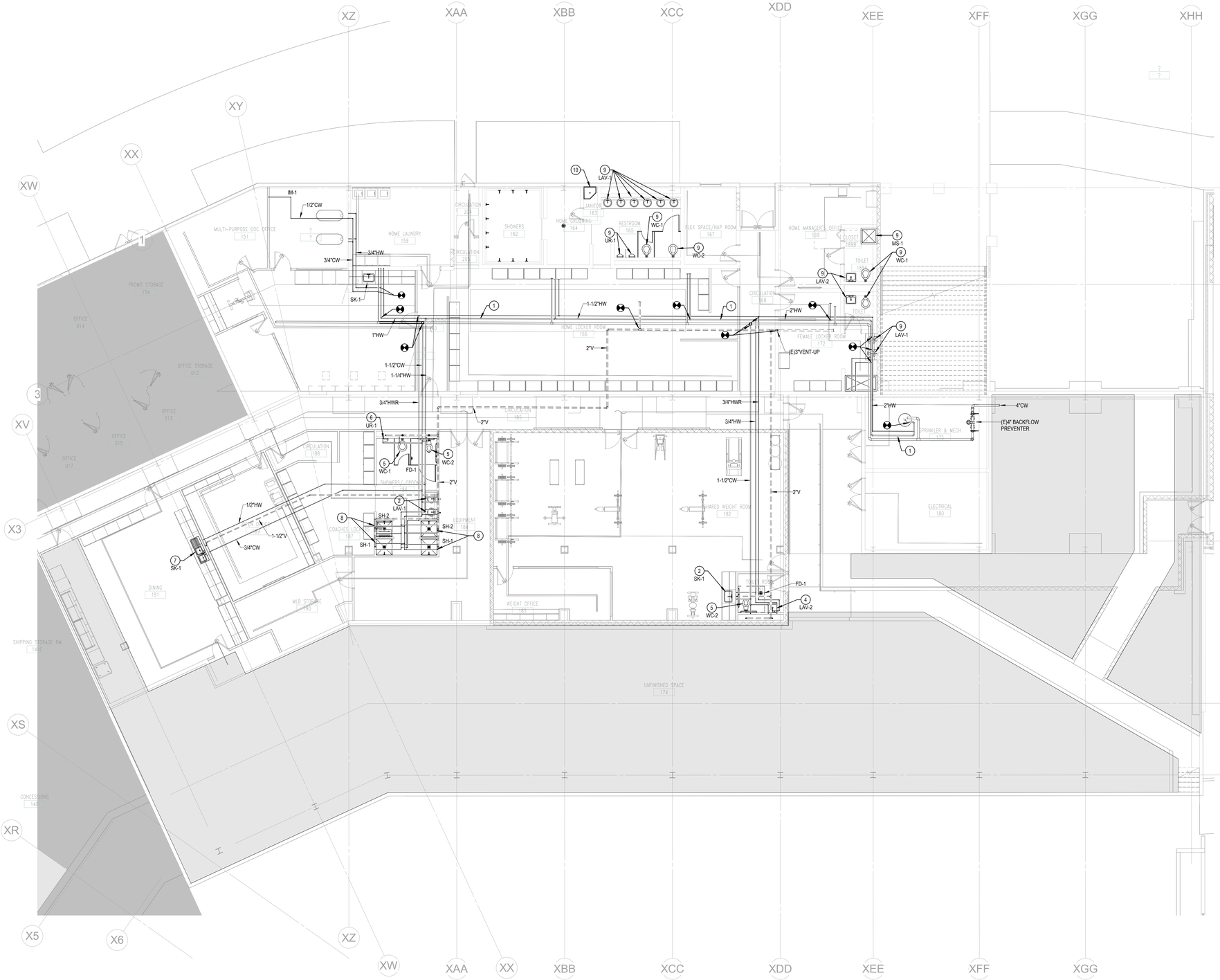

1 HOME CLUBHOUSE NEW WORK PLAN - WATER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

GENERAL NOTES

1. ALL WORK SHOWN BOLD IS CONSIDERED AS NEW TO BE PROVIDED UNDER THIS CONTRACT UNLESS NOTED OTHERWISE.
2. CONTRACTOR SHALL VERIFY ALL PIPING SIZES AND LOCATIONS IN FIELD.
3. ALL PIPING IS SHOWN DIAGRAMMATICALLY.
4. ALL PIPING IS TO BE CONCEALED IN WALLS OR ABOVE CEILING.

DRAWING NOTES

1. NEW HOT WATER PIPING ABOVE CEILING.
2. SINK (SK-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
3. LAVATORY (LAV-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
4. LAVATORY (LAV-2) - CONNECT TO COLD WATER, HOT WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
5. WATER CLOSET (WC-1)(WC-2) - CONNECT TO COLD WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
6. URINAL (UR-1) - CONNECT TO COLD WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
7. SINK (SK-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. PROVIDE GARBAGE DISPOSAL (GD-1). REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
8. SHOWER (SH-1)(SH-2) - CONNECT TO COLD WATER, HOT WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
9. CONNECT NEW FIXTURE TO EXISTING PIPING.
10. EXISTING MOP SINK TO REMAIN.

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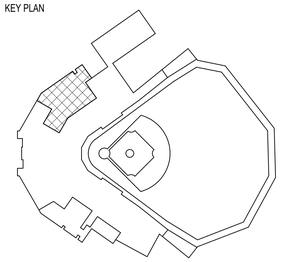

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HOME CLUBHOUSE NEW WORK PLAN - WATER

PHASE CD

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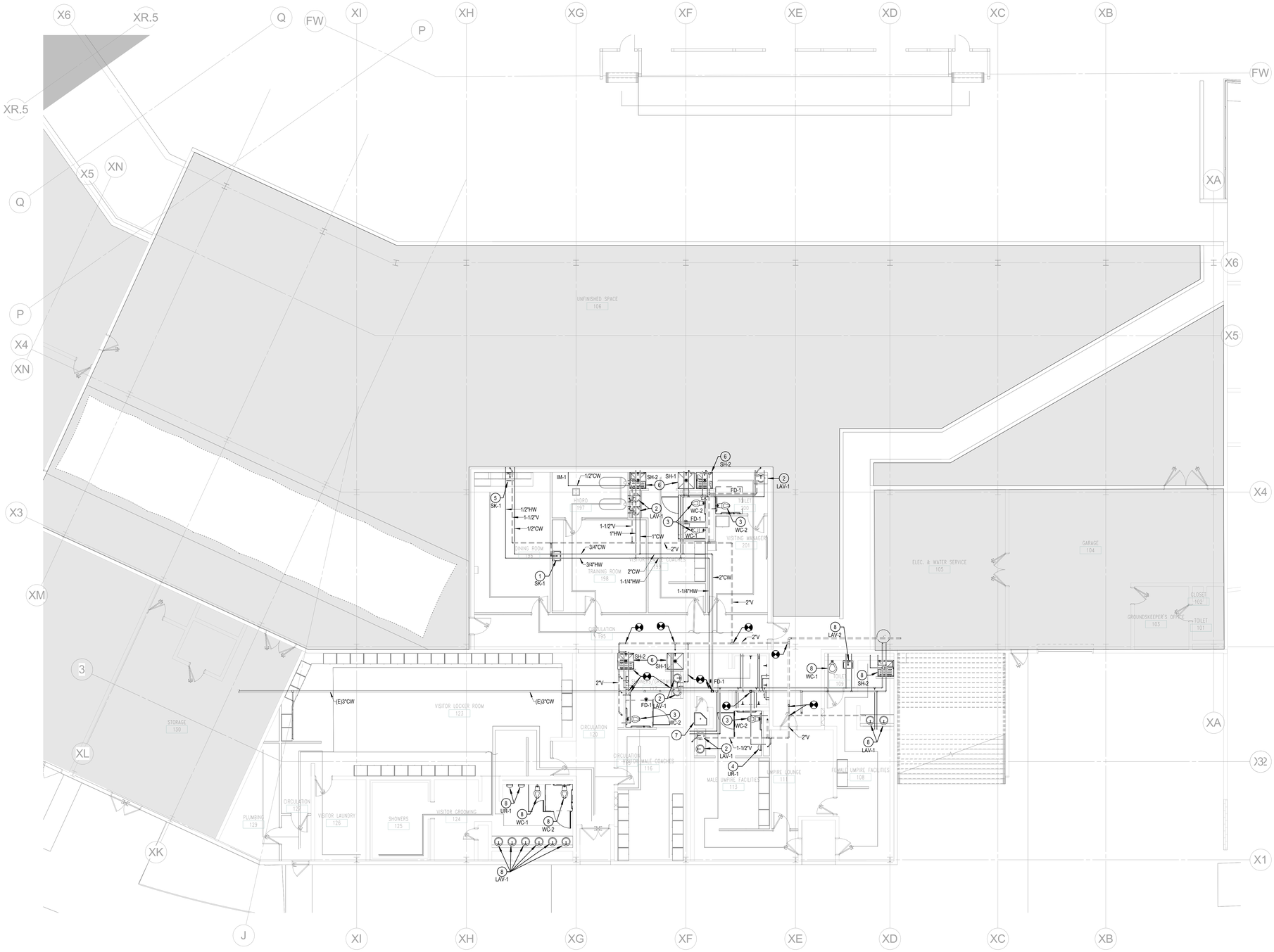

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3. ALL PIPING IS SHOWN DIAGRAMMATICALLY.

4. ALL PIPING IS TO BE CONCEALED IN WALLS OR ABOVE CEILING.

DRAWING NOTES

1. SINK (SK-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
2. LAVATORY (LAV-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
3. WATER CLOSET (WC-1)(WC-2) - CONNECT TO COLD WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
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7. EXISTING MOP SINK.
8. CONNECT NEW FIXTURE TO EXISTING PIPING.

1 VISITOR CLUBHOUSE NEW WORK PLAN - WATER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
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MARYLAND STADIUM AUTHORITY
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351 West Camden Street
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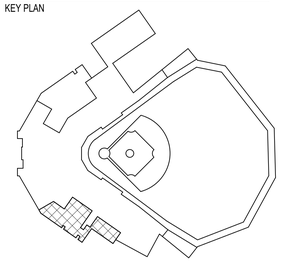
KEY PLAN



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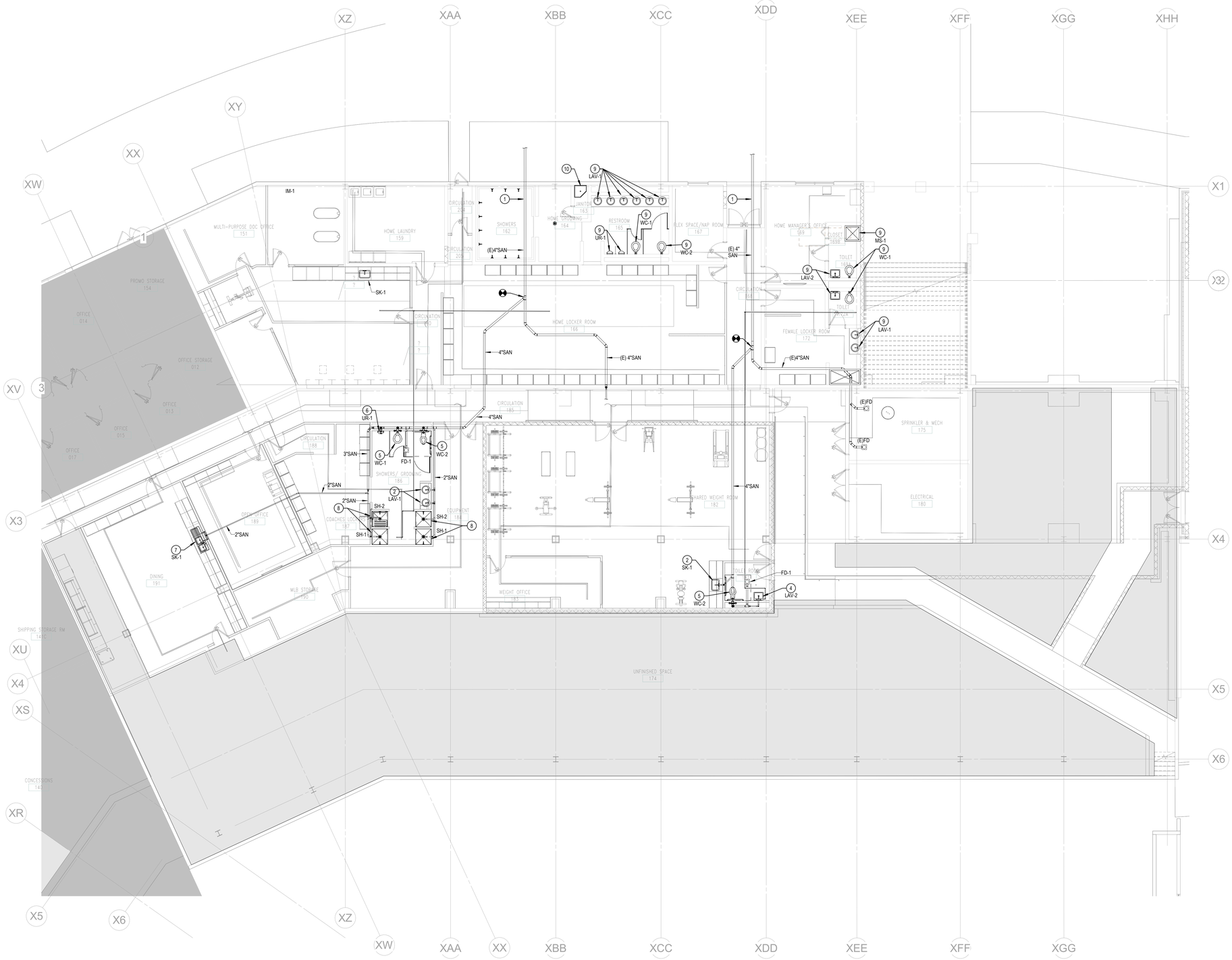

GENERAL NOTES

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2. CONTRACTOR SHALL VERIFY ALL PIPING SIZES AND LOCATIONS IN FIELD.

3. ALL PIPING IS SHOWN DIAGRAMMATICALLY.

4. ALL PIPING IS TO BE CONCEALED IN WALLS OR ABOVE CEILING.

DRAWING NOTES

1. EXISTING SANITARY PIPING BELOW FLOOR SLAB..
2. SINK (SK-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
3. LAVATORY (LAV-1) - CONNECT TO COLD WATER AND HOT WATER PIPING BELOW COUNTERTOP. CONNECT TO VENT PIPING ABOVE CEILING AND SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
4. LAVATORY (LAV-2) - CONNECT TO COLD WATER, HOT WATER AND VENT PIPING ABOVE CEILING. CONNECT TO SANITARY PIPING BELOW FLOOR SLAB. REFER TO FIXTURE CONNECTION SCHEDULE AND RISER DIAGRAM ON P0.01.
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9. CONNECT NEW FIXTURE TO EXISTING PIPING.
10. EXISTING MOP SINK TO REMAIN.

1 HOME CLUBHOUSE NEW WORK PLAN - SANITARY

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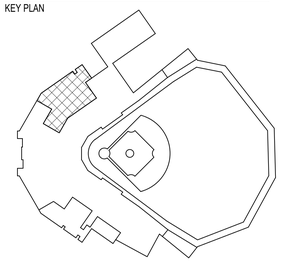

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HOME CLUBHOUSE NEW WORK PLAN - SANITARY

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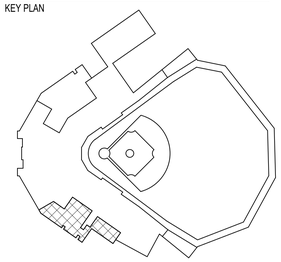

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OPEN OFFICE AREAS AND OFFICE CORRIDORS:

ON: LIGHTS AUTOMATICALLY TURN ON AT A PREDETERMINED TIME (DEFAULT IS 7AM MONDAY THROUGH SATURDAY)

OFF: LIGHTS AUTOMATICALLY TURN OFF AT PREDETERMINED TIME (DEFAULT IS 8 PM MONDAY THRU SATURDAY). A FLASH WARNING OCCURS 15-MINUTES PRIOR TO LIGHTS TURNING OFF.

CEILING MOUNTED OCCUPANCY SENSORS WILL OPERATE DURING "OFF" HOURS TO AUTOMATICALLY TURN LIGHTS ON.

OCCUPANCY SENSORS WILL BE OVERRIDDEN BY THE LIGHTING CONTROL SYSTEM TO KEEP LIGHTS ON CONTINUOUSLY DURING HOURS OF OPERATION.

OPEN AREA DAYLIGHT CONTROLS WILL OPERATE TO MAINTAIN 30 FOOTCANDLES AT DESK HEIGHT AND WILL TURN OFF ARTIFICIAL LIGHTS WHEN NATURAL LIGHT CAN SATISFY THE LIGHTING LEVEL REQUIREMENT.

PLUG LOAD CONTROL: THE CONTROLLED RECEPTACLES TURN ON AT A PREDETERMINED TIME (DEFAULT IS 7AM MONDAY THROUGH SATURDAY). THE RECEPTACLES WILL BE DE-ENERGIZED AT A PREDETERMINED TIME (DEFAULT IS 8 PM MONDAY THRU SATURDAY). CEILING MOUNTED OCCUPANCY SENSORS WILL OPERATE DURING "OFF" HOURS TO AUTOMATICALLY TURN ASSOCIATED RECEPTACLES ON.

PRIVATE OFFICES AND ENCLOSED ROOMS:

ON: LIGHTS ARE MANUALLY TURNED ON THROUGH THE USE OF A WALL MOUNTED DIMMER SWITCH.

ADJUSTMENT: THE USER CAN MANUALLY ADJUST LIGHT LEVELS USING THE WALL MOUNTED DIMMER SWITCH.

OFF: LIGHTS AUTOMATICALLY TURN OFF VIA VACANCY SENSOR AFTER 30 MINUTES OF INACTIVITY.

PLUG LOAD CONTROL: THE VACANCY SENSOR SHALL ENERGIZE THE CONTROLLED RECEPTACLES IN THE ASSOCIATED SPACE WHILE THE SPACE IS OCCUPIED. THE RECEPTACLES WILL BE DE-ENERGIZED VIA THE VACANCY SENSOR AFTER 30 MINUTES OF INACTIVITY.

CONFERENCE AND MEETING ROOMS:

ON: LIGHTS ARE MANUALLY TURNED ON THROUGH THE USE OF A WALL MOUNTED, PRE-SET SCENE LIGHTING CONTROL STATION

ADJUSTMENTS: THE USER MAY SELECT ANY OF FOUR PRESET SCENES OR MAY MANUALLY ADJUST THE ILLUMINATION LEVEL OF INDIVIDUAL LIGHTING ZONES (GROUPS OF LIGHTS).

OFF: LIGHTS AUTOMATICALLY TURN OFF VIA VACANCY SENSOR AFTER 30 MINUTES OF INACTIVITY.

DAYLIGHTING CONTROLS:

ALL AREAS WITHIN 15 FEET OF EXTERIOR WINDOWS SHALL HAVE DAYLIGHT CONTROLS THAT FUNCTION AS FOLLOWS:

ONCE THE LIGHTS ARE MANUALLY TURNED ON (ENCLOSED ROOMS) OR AUTOMATICALLY TURNED ON (OPEN OFFICE AREAS, CORRIDORS AND LOBBY SPACES) TO 100%, THE DAYLIGHT SENSOR WILL DIM OR TURNED OFF THE ARTIFICIAL LIGHTING WHEN THE NATURAL DAYLIGHTING CAN MAINTAIN 30 FOOT-CANDLES ON THE WORK SURFACE.

THE DAYLIGHT SENSOR CAN BE OVERRIDEN BY THE WALL MOUNTED, MANUAL CONTROLS.

LIGHTING CONTROL SYSTEM REQUIREMENTS:

VACANCY SENSORS, LIGHTING CONTROL POWER PACKS, RECEPTACLE CONTROL POWER PACKS AND MANUAL DIMMING CONTROL STATIONS IN PRIVATE OFFICES AND ENCLOSED ROOMS WILL BE STANDALONE SYSTEMS.

CORRIDOR AND OPEN OFFICE AREA LIGHTING CIRCUITRY SHALL BE ROUTED THROUGH LIGHTING CONTROL RELAY PANELS COMPLETE WITH RELAYS, TIME OF DAY CLOCK AND OCCUPANCY SENSOR OVERRIDE FUNCTIONS.

PROVIDE ALL DEVICES, COMPONENTS, WIRING, CONDUIT, INTERCONNECTIONS AND ACCESSORIES AS REQUIRED FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.

MANUAL OVERRIDE SWITCHES SHALL BE PROVIDED FOR THE MAIN LOBBY AREA TO OVERRIDE TIME-OF DAY SETTINGS AND DAYLIGHTING CONTROLS AND SHALL BE GANGED TOGETHER IN A COMMON LOCATION. FIELD COORDINATE EXACT LOCATIONS OF OVERRIDE SWITCHES WITH THE MSI.

EMERGENCY EGRESS LIGHTING SHALL NOT BE ROUTED THROUGH LIGHTING CONTROLS.

LIGHTING CONTROL SEQUENCE OF OPERATIONS

SPACE TYPE	SEQUENCE OF OPERATION
SOFTBALL FACILITY	CONTROLLED BY CEILING MOUNTED VACANCY SENSORS AND WALL MOUNTED OVERRIDE SWITCH. ON: DURING BUSINESS HOURS LIGHTS ARE MANUALLY TURN ON BY WALL MOUNTED OVERRIDE SWITCH. OFF: LIGHTS AUTOMATICALLY TURN OFF BY CEILING MOUNTED VACANCY SENSORS AFTER 20 MINUTES OF INACTIVITY. CEILING MOUNTED VACANCY SENSORS SHALL BE OVERRIDDEN BY THE LIGHTING CONTROL SYSTEM TO KEEP LIGHTS ON CONTINUOUSLY DURING NORMAL HOURS OF OPERATION.
EXTERIOR	LIGHTS CONTROLLED BY PHOTOCELL. ON: LIGHTS AUTOMATICALLY TURN ON BY INTEGRAL MOTION SENSOR AND PHOTOCELL PROGRAMMED FOR DUSK TO DAWN OPERATION. OFF: LIGHTS AUTOMATICALLY TURN OFF BY INTEGRAL PHOTOCELL. EXTERIOR LIGHTS SHALL DIM TO 30% BETWEEN THE HOURS OF MIDNIGHT AND 6AM IF NO MOTION IS DETECTED VIA INTEGRAL MOTION SENSOR.
STORAGE, ELECTRICAL / IT ROOMS	CONTROLLED BY WALL MOUNTED TIME SWITCH. ***BASIS OF DESIGN IS TORK DIGITAL SSA-200*** ON / OFF: ELECTRONIC TIME SWITCH THAT COUNTS DOWN THE TIME REMAINING AND FLASH PRIOR TO TURNING OFF. TIME FRAME UP TO 8 HOURS.

LIGHTING CONTROL NOTES

1. PROVIDE ALL COMPONENTS, WIRING, CONDUIT, INTERCONNECTIONS, OVERRIDE AND ACCESSORIES AS REQUIRED FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
2. FIELD COORDINATE EXACT LOCATIONS OF OVERRIDE SWITCHES AND OCCUPANCY SENSORS WITH OWNER/ARCHITECT.
3. COORDINATE HOURS OF OPERATION WITH OWNER/ARCHITECT.

LIGHTING GENERAL NOTES

1. ARCHITECT TO CONFIRM FINISH
2. REFER TO ARCHITECT'S DETAILS FOR MOUNTING INFORMATION
3. REFER TO MANUFACTURER'S TECHNICAL INSTRUCTIONS FOR MOUNTING INFORMATION AND POWER SUPPLY INFORMATION
4. CONTRACTOR TO PROVIDE ALL NECESSARY MOUNTING ACCESSORIES
5. CONFIRM CEILING MATERIAL AND COMPATIBILITY WITH FIXTURE TO ENSURE CORRECT MOUNTING CONDITION
6. DRIVER AND POWER SUPPLY TO BE CONCEALED - LOCATION TO BE DETERMINED IN ACCESSIBLE CEILING WITHIN MANUFACTURER RECOMMENDED DISTANCES
7. CONTRACTOR TO PROVIDE LENGTHS AS NEEDED FOR EVEN ILLUMINATION.

POWER GENERAL NOTES

1. REFER TO ARCHITECTURAL DRAWINGS EXACT LOCATION OF ALL DEVICES.
2. REFER TO ARCHITECTURAL AND AV DRAWINGS FOR ADDITIONAL REQUIREMENTS / INFORMATION.
3. CONTRACTOR SHALL COORDINATE ALL AV, IT AND SECURITY REQUIREMENTS WITH ARCHITECT AV, IT AND SECURITY CONSULTANT DOCUMENTS. CONTRACTOR SHALL PROVIDE ALL CONDUIT, WIRING AND ACCESSORIES REQUIRED FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
4. FIRESTOP PENETRATIONS IN RATED WALLS AND SLAB UPON COMPLETION.
5. ALL RECEPTACLES IN AREAS WITH SINKS SHALL BE GFCI TYPE DEVICES.
6. CONTRACTOR SHALL CONFIRM ELECTRICAL CHARACTERISTICS OF ALL EQUIPMENT WITH ARCHITECT AND TENANT. CONTRACTOR SHALL PROVIDE ALL CONDUIT, WIRING AND ACCESSORIES REQUIRED FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM.
7. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION AND ADDITIONAL REQUIREMENTS OF ALL PLUMBING EQUIPMENT.
8. REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATION AND ADDITIONAL REQUIREMENTS OF ALL MECHANICAL EQUIPMENT

DRY TYPE TRANSFORMER SCHEDULE GENERAL NOTES

1. PROVIDE PRIMARY AND/OR SECONDARY OVERCURRENT PROTECTOR AT TRANSFORMER OF SIZE SHOWN IN SCHEDULE WHEN INDICATED ON RISER DIAGRAM, ONE-LINE DIAGRAM OR FLOOR PLANS.
2. PROVIDE PRIMARY FEEDERS OF SIZES SHOWN IN SCHEDULE FROM PRIMARY FUSED SWITCH/CB LOAD LUGS TO TRANSFORMER PRIMARY TERMINALS UNLESS OTHERWISE NOTED.
3. PROVIDE SECONDARY FEEDERS OF SIZES SHOWN IN SCHEDULE. FROM TRANSFORMER SECONDARY TERMINALS TO THE PANELBOARD OR SECONDARY OVERCURRENT PROTECTIVE DEVICE, UNLESS OTHERWISE NOTED.
4. GROUND WIRE SIZES ARE BASED ON EQUIPMENT GROUND CONDUCTOR PER NEC TABLE 250-122.
5. TRANSFORMER SECONDARY DERIVED SYSTEM GROUNDING ELECTRODE CONDUCTORS ARE SIZED PER NEC TABLE 250-66.

LIGHTING FIXTURE SYMBOLS

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
	EXIT SIGNS	
	1x4 RECESSED LIGHTING FIXTURE	
	1x4 RECESSED LIGHTING FIXTURE - EMERGENCY	
	2x4 RECESSED LIGHTING FIXTURE	
	2x4 RECESSED LIGHTING FIXTURE - EMERGENCY	
	6"x4 RECESSED LIGHTING FIXTURE	
	6"x4 RECESSED LIGHTING FIXTURE - EMERGENCY	
	2x2 RECESSED LIGHTING FIXTURE	
	2x2 RECESSED LIGHTING FIXTURE - EMERGENCY	
	RECESSED SQUARE DOWNLIGHT FIXTURE	
	RECESSED SQUARE DOWNLIGHT FIXTURE - EMERGENCY	
	1x4 SURFACE LIGHTING FIXTURE	
	1x4 SURFACE LIGHTING FIXTURE - EMERGENCY	
	2x4 SURFACE LIGHTING FIXTURE	
	2x4 SURFACE LIGHTING FIXTURE - EMERGENCY	
	2x2 SURFACE LIGHTING FIXTURE	
	2x2 SURFACE LIGHTING FIXTURE - EMERGENCY	
	RECESSED ROUND DOWNLIGHT FIXTURE	
	RECESSED ROUND DOWNLIGHT FIXTURE - EMERGENCY	
	EXIT SIGNS	
	STRIP FIXTURE	
	WALL MOUNTED STRIP FIXTURE	+7'-6"
	WALL MOUNTED STRIP FIXTURE - EMERGENCY	+7'-6"
	WALL PACK	+4'-0"
	WALL PACK - EMERGENCY	+4'-0"
	PENDANT MOUNTED LINEAR FIXTURE	
	PENDANT MOUNTED LINEAR FIXTURE - EMERGENCY	
	COVE LIGHTING	
J	LIGHTING JUNCTION BOX	

LIGHTING DEVICE SYMBOLS

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
$	SINGLE POLE SWITCH	+48"
$OS	OCCUPANCY SENSOR	+48"
$VS	VACANCY SENSOR	
$DO	OCCUPANCY SENSOR - DIMMER	+48"
$D	DIMMER	+48"
$4	4-WAY SWITCH	+48"
$CB	CIRCUIT BREAKER	+48"
$3	3-WAY SWITCH	+48"
$T	TIMER SWITCH	+48"
C	LIGHTING CONTROL	+48"
C	WALL MOUNTED OCCUPANCY SENSOR	+7'-6"
S	WALL MOUNTED PHOTO CELL	+7'-6"
C (DS)	DAYLIGHTING SENSOR	
(OS)	DAYLIGHTING SENSOR	
(VS)	DAYLIGHTING SENSOR	
RC	ROOM CONTROLLER	
PC	PHOTO CELL	

POWER SYMBOLS

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
	CEILING MOUNTED DUPLEX RECEPTACLE	
	CEILING MOUNTED QUAD	
	CEILING MOUNTED SIMPLEX	
	SPECIAL RECEPTACLE - CABLE TRAY OR RACK MOUNTED. COORDINATE WITH IT DRAWINGS FOR ADDITIONAL INFORMATION.	
	FLOOR MOUNTED BOX - POWER ONLY. REFER TO THE FLOOR BOX SCHEDULES ON SHEET EX.X. POWER CONDUIT SHALL HOMERUN TO RESPECTIVE PANELBOARD.	
	FLOOR MOUNTED BOX - POWER AND TELE/DATA. REFER TO THE FLOOR BOX SCHEDULES ON SHEET EX.X. POWER CONDUIT SHALL HOMERUN TO RESPECTIVE PANELBOARD. TELE/DATA CONDUITS SHALL HOMERUN TO RESPECTIVE TELEPHONE CLOSET.	
AV	FLOOR MOUNTED BOX - POWER, TEL/DATA AND A/V. REFER TO FLOOR BOX SCHEDULES ON SHEET EX.X. POWER CONDUIT SHALL HOMERUN TO RESPECTIVE PANELBOARD. TEL/DATA SHALL HOMERUN TO RESPECTIVE TELEPHONE CLOSET. A/V CONDUITS SHALL BE ROUTED TO RESPECTIVE AV RACK LOCATIONS.	
	FLOOR MOUNTED BOX - TEL/DATA ONLY. REFER TO THE FLOOR BOX SCHEDULES ON SHEET EX.X. TEL/DATA SHALL HOMERUN TO RESPECTIVE TELEPHONE CLOSET.	
FF	FLOOR MOUNTED BOX - FURNITURE FEED. WIREMOLD EVOLUTION EFBFF WITH FPFFTCBS COVER FOR SLAB ON GRADE & WIREMOLD 6ATCFFBS FOR ELEVATED SLABS. POWER CONDUIT SHALL HOMERUN TO RESPECTIVE PANELBOARD. TELE/DATA CONDUITS SHALL HOMERUN TO RESPECTIVE TELEPHONE CLOSET.	
FP	FURNITURE FEED, WALL MOUNTED	+18"
M	MOTOR WITH DISCONNECT SWITCH	
M	MOTOR	
J	JUNCTION BOX	
	DUPLEX RECEPTACLE - 2P,3W, 20A, 125A, GROUNDED NEMA 5-20R - NORMAL POWER	+18"
	GFI DUPLEX RECEPTACLE - 2P, 3W, 20A, 125A, GROUNDED NEMA 5-20R - MOUNTED AT 18" AFF.	+18"
	GFI DUPLEX RECEPTACLE - 2P,3W, 20A, 125A, GROUNDED NEMA 5-20R - MOUNTED AT 44" AFF.	+44"
	QUADRAPLEX RECEPTACLE - 2P,3W, 20A, 125A, GROUNDED NEMA 5-20R - NORMAL POWER	+18"
	USB TYPE DUPLEX RECEPTACLE - 2P,3W, 20A, 125A, GROUNDED NEMA 5-20R - NORMAL POWER	+18"
	SPECIAL RECEPTACLE - COORDINATE NEMA CONFIGURATION WITH EQUIPMENT SERVE.	
J J J	JUNCTION BOX - SEE FLOOR PLANS FOR EQUIPMENT SERVED. COORDINATE LOCATION AND MOUNTING HEIGHT.	
$	POWER TOGGLE SWITCH	
$M	MANUAL MOTOR STARTER SWITCH WITH THERMAL OVERLOAD PROTECTION.	

ELECTRICAL EQUIPMENT SYMBOLS

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
ATS	AUTOMATIC TRANSFER SWITCH	
SB	SWITCHBOARD	
	COMBINATION MOTOR STARTER AND DISCONNECT SWITCH	
	DISCONNECT	
T	TRANSFORMER	
	PANELBOARD	

WIRING TYPES

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
2S L8-1,3	HOMERUN TO PANELBOARD - NUMBER OF ARROWHEADS INDICATES NUMBER OF CIRCUITS. NUMERAL AND LETTERS ADJACENT TO ARROWHEADS INDICATE ASSIGNED PANEL AND CIRCUIT NUMBERS. SUBSCRIPT "S" DENOTES SYSTEMS FURNITURE (GENERAL) RECEPTACLES THAT ARE SWITCHED. TICK MARKS IN CIRCUITRY INDICATE QUANTITY OF 12 HOT, NEUTRAL AND GROUND CONDUCTORS. ALL CONDUCTORS ARE NO. 12 UNLESS NOTED OTHERWISE.	
2S L8-1,3	HOMERUN IN FLOOR TO PANELBOARD - NUMBER OF ARROWHEADS INDICATES NUMBER OF CIRCUITS. NUMERAL AND LETTERS ADJACENT TO ARROWHEADS INDICATE ASSIGNED PANEL AND CIRCUIT NUMBERS. SUBSCRIPT "S" DENOTES SYSTEMS FURNITURE (GENERAL) RECEPTACLES THAT ARE SWITCHED. TICK MARKS IN CIRCUITRY INDICATE QUANTITY OF 12 HOT, NEUTRAL AND GROUND CONDUCTORS. ALL CONDUCTORS ARE NO. 12 UNLESS NOTED OTHERWISE.	

LIGHTNING PROTECTION SYMBOLS

SYMBOLS	DESCRIPTION	MTG HEIGHT TO CL A.F.F. U.O.N.
*	LIGHTNING PROTECTION ROD / AIR TERMINAL	
	THROUGH-ROOF CONNECTION TO DOWN CONDUCTOR	
	GROUND ROD	
	GROUNDING ELECTRODE CONDUCTOR, UNDERGROUND	

ABBREVIATIONS

A	AMPERE	HP	HORSEPOWER
AFF	ABOVE FINISHED FLOOR	MCB	MAIN CIRCUIT BREAKER
AIC	AMPERES INTERRUPTING CAPACITY	MLO	MAIN LUGS ONLY
AS	ABOVE SLAB	MTD	MOUNTED
ATS	AUTOMATIC TRANSFER SWITCH	MTS	MANUAL TRANSFER SWITCH
C	CONDUIT / EMT	OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
CM	CEILING MOUNTED	N	NEW
E	EXISTING	No.	NUMBER
EC	EMPTY CONDUIT / EMT	OFCI	OWNER FURNISHED CONTRACTOR INSTALL
E.G.	EQUIPMENT GROUND	P	POLE
EM	EMERGENCY	PNL	PANEL
EN	EXISTING SHOWN IN NEW LOCATION	S/T	SHUNT TRIP
ER	EXISTING TO BE RELOCATED	U.O.N.	UNLESS OTHERWISE NOTED
FAAP	FIRE ALARM ANNUCIATOR PANEL	V	VOLT
FACP	FIRE ALARM CONTROL PANEL	VWA	VERIFY WITH ARCHITECT
FAEP	FIRE ALARM EXPANDER PANEL	W	WIRE
G	GROUND	WP	WEATHERPROOF
GFI	GROUND FAULT INTERRUPT		

LIGHT FIXTURE SCHEDULE

C406.3 EFFICIENT LIGHTING SYSTEM CALCULATIONS

Type Mark	Manufacturer	Model	Lamp	Apparent Load	Mounting Location	Voltage	Count	Total Wattage	Alternate	Type Comments	Poles	Load Classification
	<varies>	<varies>	<varies>				14			<varies>		
A	LEDALUX	HBRE-14L-SK-80-102	LED	102 VA		277 V	35			3.5" Min.Radius	1	Lighting
B(4')	Finelite	HP 2 R D 4' B 840 F 96LG 277 SC FC-10% C2 FE SW	LED	36 VA		277 V	2			Linear Lighting Fixture	1	Lighting
B(6')	<varies>	<varies>	LED	<varies>		277 V	5			Linear Lighting Fixture	<varies>	Lighting
B(8')	StarTek Lighting		LED	0 VA		277 V	14			Linear Lighting Fixture	1	Lighting
B(10')	Finelite	HP 2 R D 10' B 840 F 96LG 277 SC FC-10% C2 FE SW	LED	<varies>	<varies>	277 V	11			<varies>	1	Lighting
B(16')	Finelite	HP 2 R D 16' B 840 F 96LG 277 SC FC-10% C2 FE SW	LED	144 VA		277 V	13			Linear Lighting Fixture	1	Lighting
C1	LITHONIA	EPANL 2X4 3000LM 80CRI 40K MIN10 ZT MVOLT	LED	29 VA		277 V	98				1	Lighting
C2				0 VA		277 V	12				1	Lighting
EXT.1	LITHONIA	WDGE3-LED-P2-50K-80CRI-R4-MVOLT-SRM-E15W-PE-P IRPC3V-DDBXD	LED	59 VA	Surface	277 V	2				1	Lighting - Exterior
F	LITHONIA	LDN4 35/10 20 L04 AR LSS TRW MVOLT GZ10	LED	32 VA		277 V	216				1	Lighting
S1	LITHONIA	WST LED P1 40K VW MVOLT DDBXD	LED	14 VA	Surface	277 V	11				1	Lighting - Exterior
X1	Lithonia	Do not use; use Model Number.	Do not use; Use Lamp Type	3 VA		277 V	2				1	Lighting - Interior

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KEY PLAN

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B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ.NO. 20230573/23062 SCALE NO SCALE

DRAWING NAME

SYMBOLS, ABBREVIATIONS AND NOTES

PHASE
CD

DRAWING NO.
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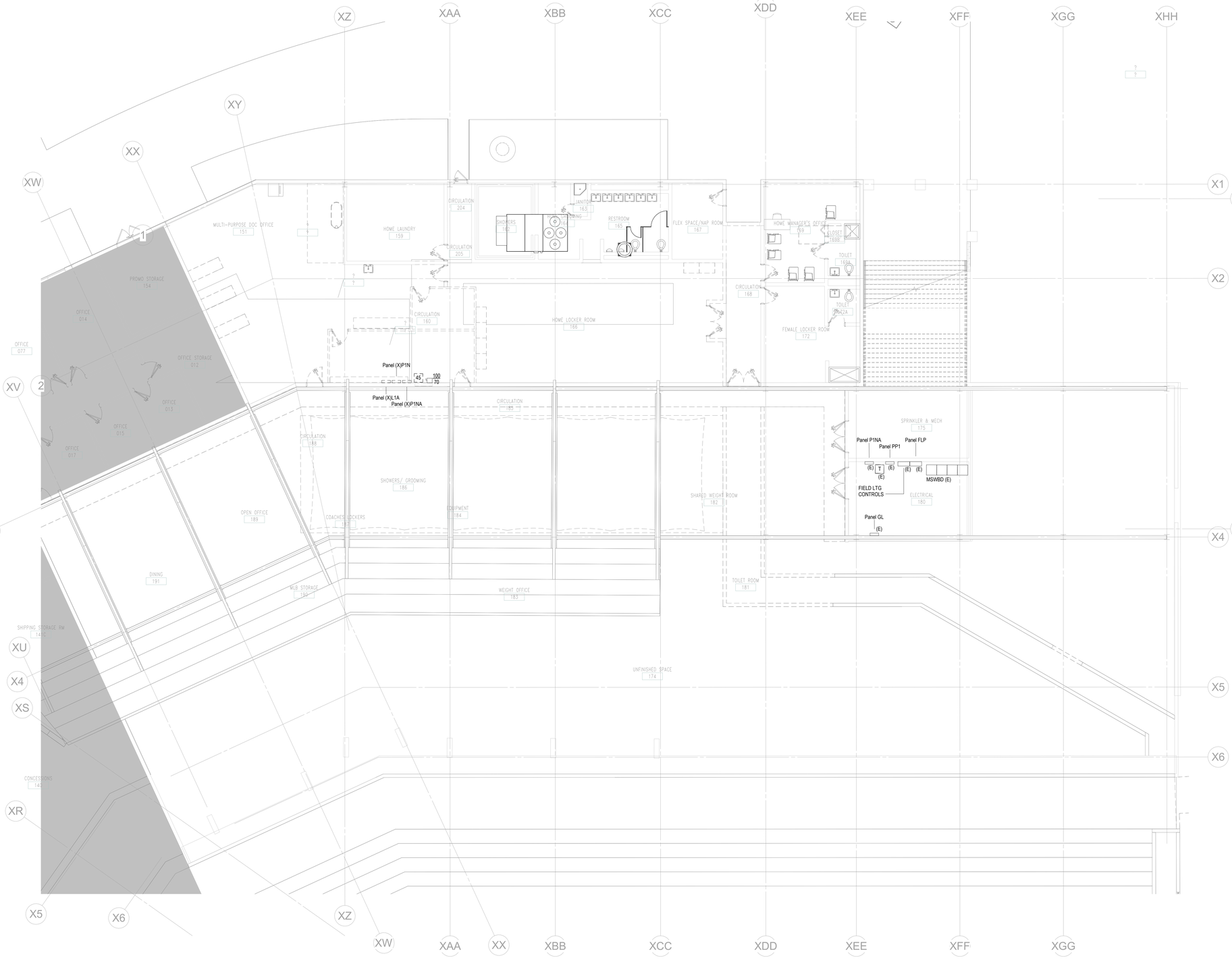

1 HOME CLUBHOUSE DEMO PLAN - POWER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

GENERAL ELECTRICAL DEMOLITION NOTES

1. REQUIRED DEMOLITION WORK SHALL NOT BE LIMITED TO THAT PORTION SHOWN ON PLANS ALONE, BUT SHALL INCLUDE ALL NECESSARY WORK BY THIS CONTRACTOR AFTER VISITING THE SITE PRIOR TO BIDDING. CONTRACTOR SHALL GATHER ALL THE INFORMATION AND COORDINATE WITH THE NEW OR MODIFIED WORK AS INDICATED ON THE DRAWINGS. ANY MAJOR DISCREPANCIES FOUND ON THE DRAWINGS AND SPECIFICATIONS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION, IN WRITING, BEFORE SUBMITTING THE BIDS.
2. THE SCHEDULING OF DEMOLITION WORK SHALL BE COORDINATED BY THIS CONTRACTOR WITH THE OWNER'S REPRESENTATIVE PRIOR TO PERFORMING THE WORK. CONTRACTOR SHALL NOTIFY / OBTAIN PERMISSION 10 DAY PRIOR TO ANY OUTAGE.
3. CONTRACTOR SHALL VISIT JOB SITE TO ASCERTAIN CONDITIONS WHICH MAY AFFECT HIS BID AND WORK, AND HE SHALL BE RESPONSIBLE FOR THE INCLUSION OF ALL REQUIRED DEMOLITION IN AREAS UNDERGOING MODIFICATION WHETHER OR NOT SUCH WORK IS INDICATED ON PLANS OR NOTES.
4. CONTRACTOR SHALL CLEAN THE PROJECT SITE AT THE END OF EACH WORKING DAY. AFTER REMOVAL OF ALL DEVICES, CONTRACTOR SHALL TURN ALL DEVICES OVER TO OWNER'S REPRESENTATIVE FOR HIM TO INSPECT. AFTER INSPECTION BY THE OWNER'S REPRESENTATIVE CONTRACTOR SHALL REMOVE ALL UNWANTED DEVICES OR MATERIALS FROM THE SITE.
5. THE CONTINUITY OF ALL EXISTING CIRCUITS WHICH ARE TO REMAIN OPERATIONAL SHALL BE MAINTAINED THROUGHOUT THE FACILITY DURING DEMOLITION, CONSTRUCTION AND AT THE CONCLUSION OF CONSTRUCTION.
6. THE CONTRACTOR SHALL IDENTIFY ALL CIRCUITS THAT SUPPLY POWER TO AREAS TO REMAIN. MARK THESE CIRCUITS AND MAKE SURE THEIR POWER IS NOT INTERRUPTED DURING DEMOLITION AND CONSTRUCTION. ALL EXISTING CIRCUITS TO REMAIN SHALL BE RECONNECTED TO NEW OR EXISTING PANELS. PROVIDE NEW WIRING AND CIRCUIT BREAKERS OF RATING TO MATCH EXISTING AS REQUIRED.
7. THE CONTRACTOR SHALL MAKE A CAREFUL INSPECTION OF ALL OF THE EXISTING ELECTRICAL POWER AND SYSTEMS PRIOR TO THE MODIFICATION OF THE EXISTING SPACE. PHYSICALLY VERIFY ALL EXISTING BRACH CIRCUITS AND COORDINATE PANEL BOARD OVER CURRENT PROTECTION DEVICE, SIZE AND LOCATION.
8. ALL MECHANICAL EQUIPMENT IS EXISTING TO REMAIN UNLESS OTHERWISE NOTED. REFER TO MECHANICAL PLANS FOR ADDITIONAL INFORMATION.
9. REMOVE ALL EXISTING FIRE ALARM STROBES AND ALL ASSOCIATED PATHWAYS, BOXES AND WIRE UNLESS OTHERWISE NOTED.
10. ALL LIGHT FIXTURES IN AREA OF WORK ARE EXISTING TO BE REMOVED UNLESS OTHERWISE NOTED. REMOVE ALL CONDUIT AND WIRING.
11. ALL LIGHT FIXTURES AND WIRING DEVICES IN AREA OF WORK ARE EXISTING TO BE REMOVED UNLESS OTHERWISE NOTED. REMOVE ALL CONDUIT AND WIRING.

DEMOLITION NOTES

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2. PLAN NOTE NUMBER 2
3. PLAN NOTE NUMBER 3
4. PLAN NOTE NUMBER 4
5. PLAN NOTE NUMBER 5

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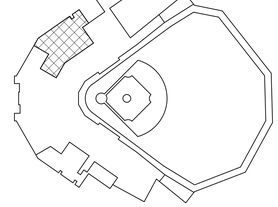

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE - DEMO PLAN - POWER

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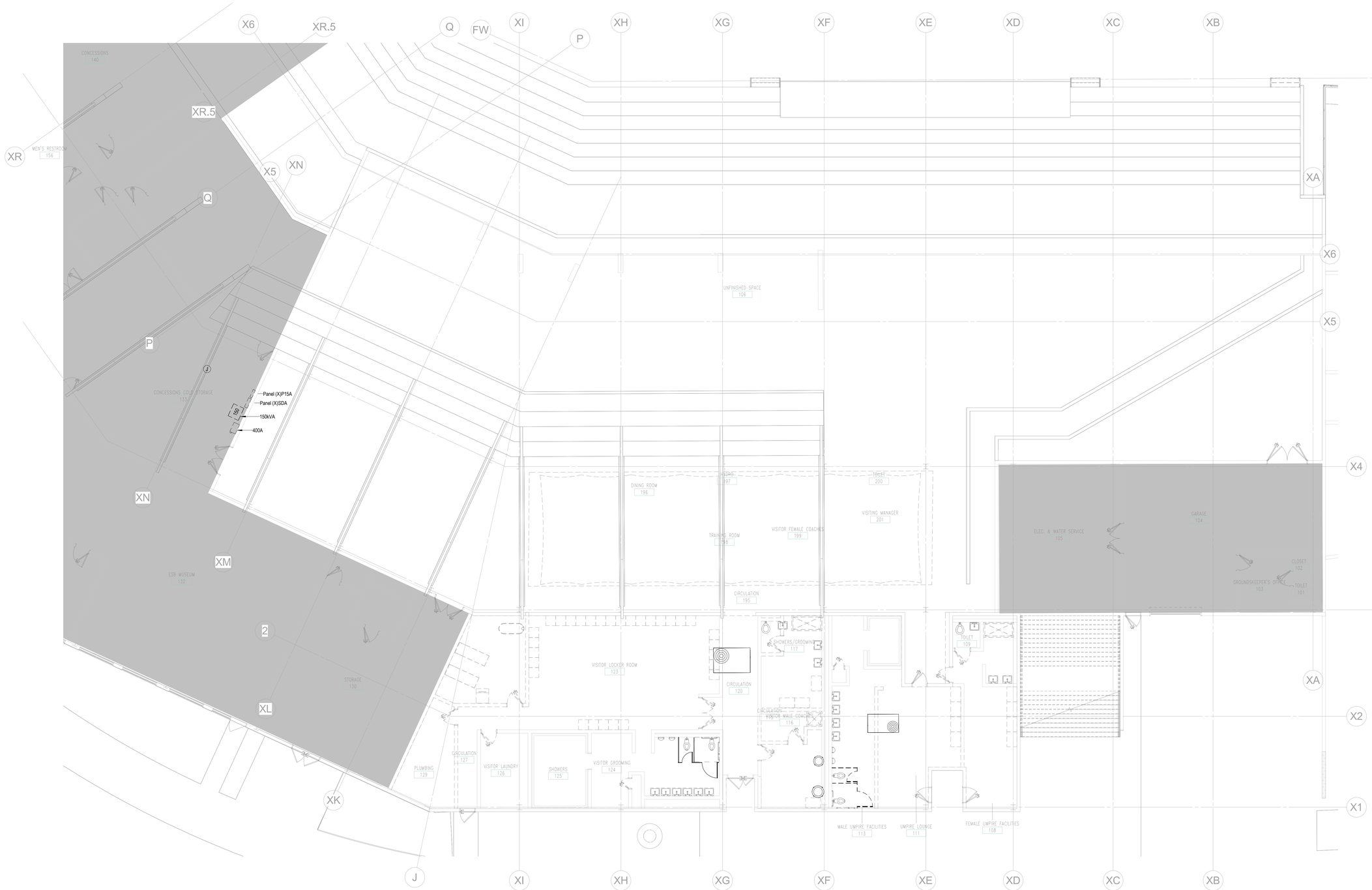

1 VISITOR CLUBHOUSE DEMO PLAN - POWER

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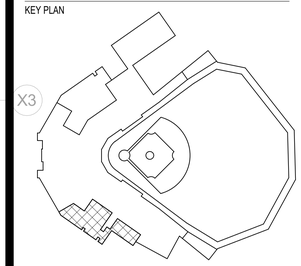

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DRAWING NAME

VISITOR CLUBHOUSE - DEMO PLAN - POWER

PHASE
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DRAWING NOTES

1. EQUIPMENT IN THIS ROOM IS EXISTING TO REMAIN. REFEED - PROVIDE NEW CIRCUITS FROM NEW PANEL BOARDS AND PROVIDE NEW DEVICES AND COVERPLATES TO MATCH EXISTING.
2. 208V, 1PH, 30A FOR KEISER SYSTEM COMPRESSOR, MTD AT 76" A.F.F. (COORDINATE EXACT HEIGHT AND LOCATION WITH THE EQUIPMENT MANUFACTURER).

1 HOME CLUBHOUSE NEW WORK PLAN - POWER
SCALE: 1/8" = 1'-0"

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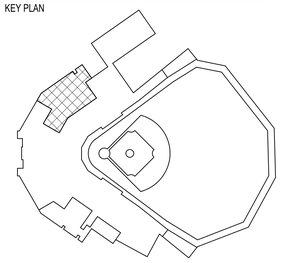

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HOME CLUBHOUSE NEW WORK PLAN - POWER

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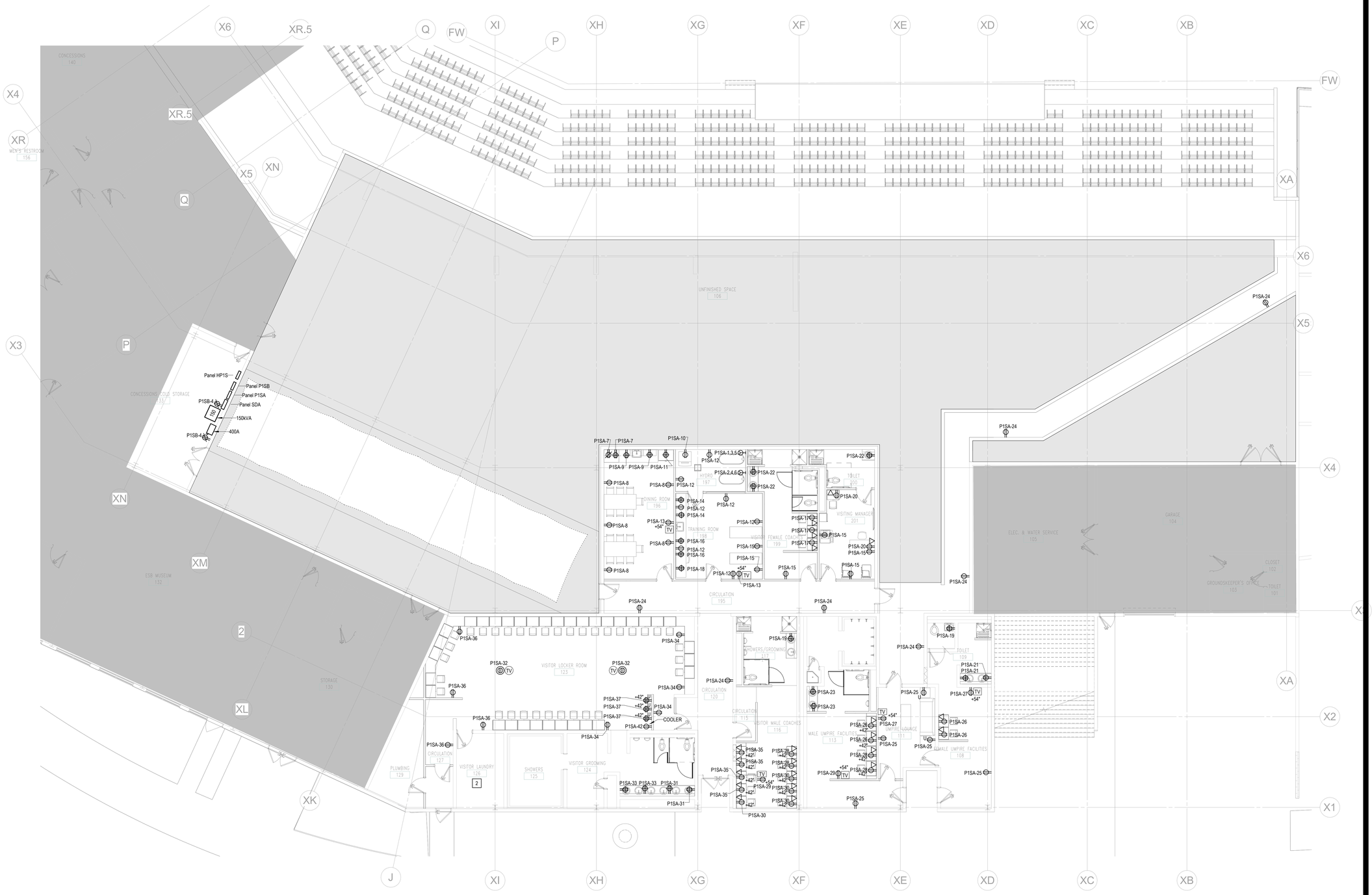

DRAWING NOTES

1 EQUIPMENT IN THIS ROOM IS EXISTING TO REMAIN. REFEED - PROVIDE NEW CIRCUITS FROM NEW PANEL BOARDS AND PROVIDE NEW DEVICES AND COVERPLATES TO MATCH EXISTING.

1 VISITOR CLUBHOUSE NEW WORK PLAN - POWER
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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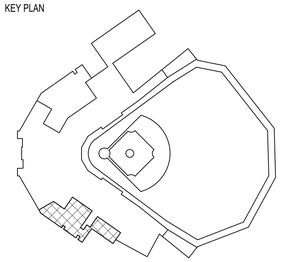

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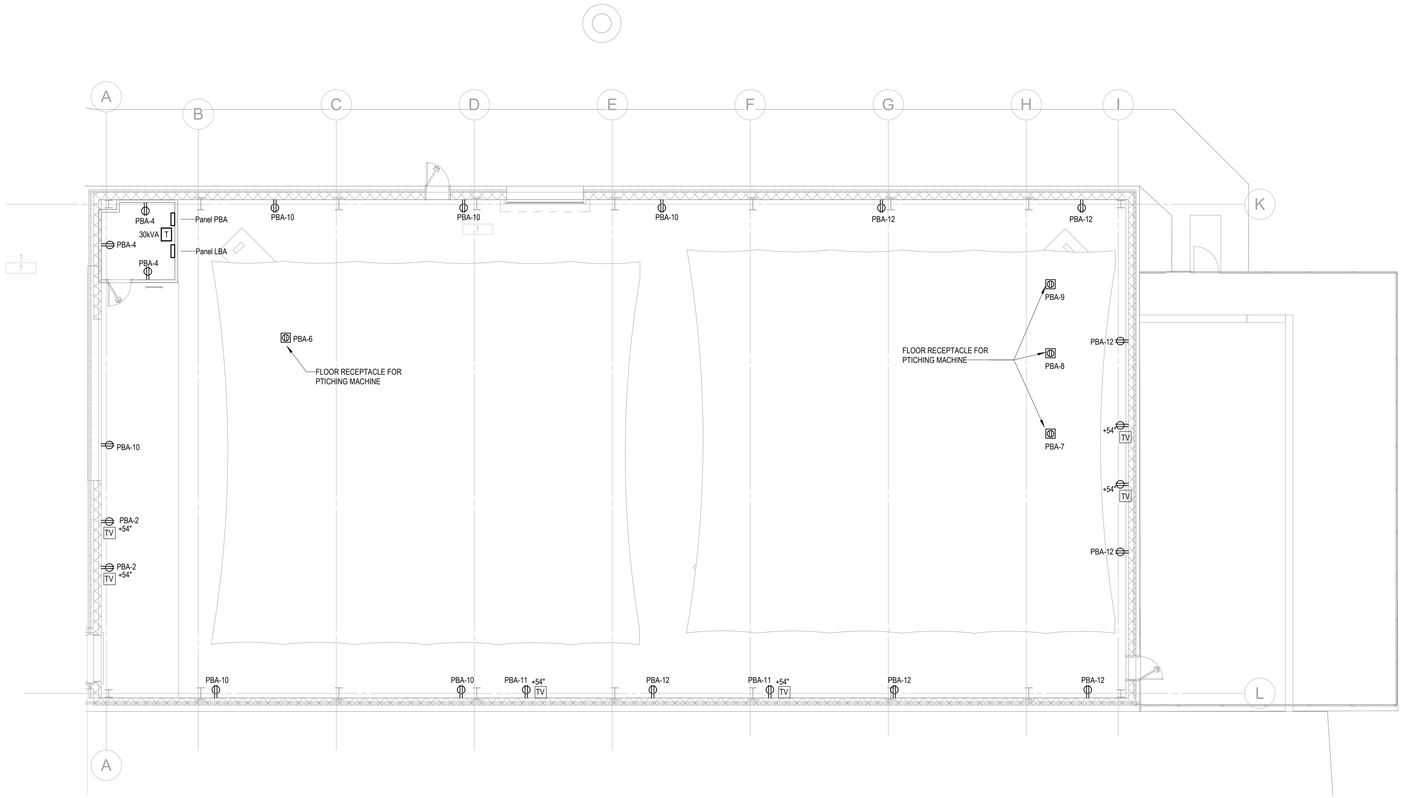
3. PLAN NOTE NUMBER 3
4. PLAN NOTE NUMBER 4
5. PLAN NOTE NUMBER 5



1 HOME CLUBHOUSE BATTING ARENA PLAN - POWER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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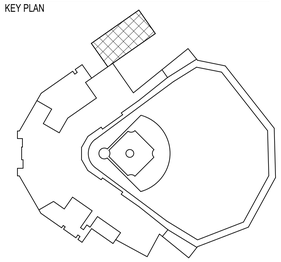

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DRAWING NAME

HOME CLUBHOUSE BATTING ARENA PLAN - POWER

PHASE
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DRAWING NOTES

1 JUNCTION BOX FOR CANOPY LIGHTING. COORDINATE CANOPY LIGHTING WITH CANOPY MANUFACTURER.

1 HOME BULLPEN - POWER
SCALE: 1/4" = 1'-0"

SCALE : 1/4" = 1'-0"

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane

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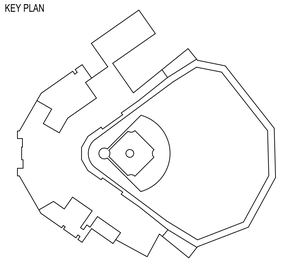
KEY PLAN



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Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ.NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME BULLPEN PLAN - POWER

PHASE
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DRAWING NO.
E1.1.4

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DRAWING NOTES

1 JUNCTION BOX FOR CANOPY LIGHTING. COORDINATE CANOPY LIGHTING WITH CANOPY MANUFACTURER.

1 VISITOR BULLPEN - POWER

SCALE: 1/4" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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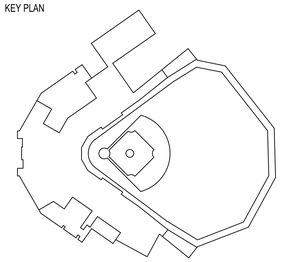

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

VISITOR BULLPEN PLAN - POWER

PHASE
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DRAWING NO.
E1.1.5

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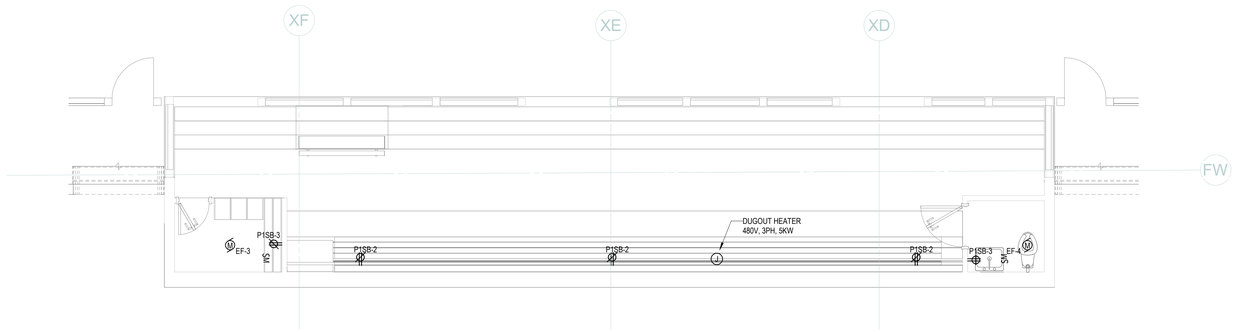
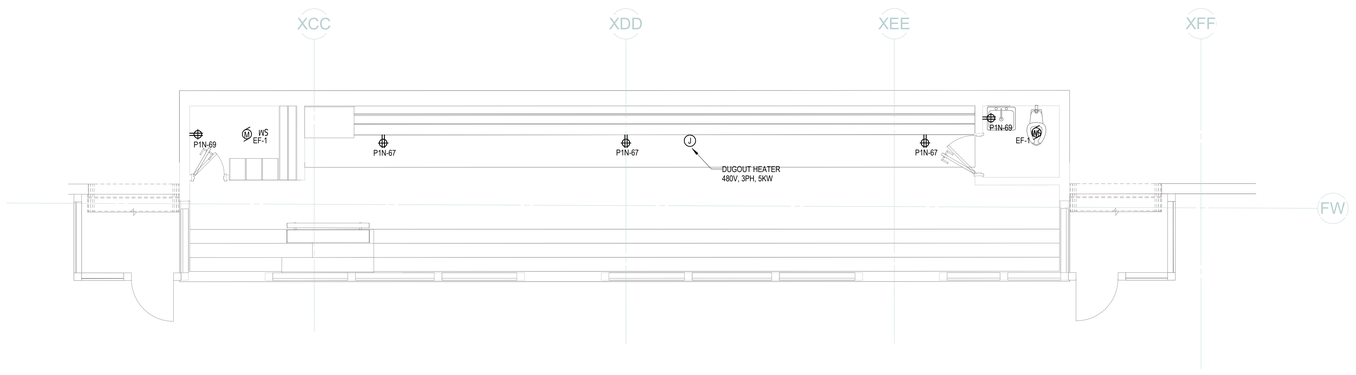


1 VISITOR DUGOUT - POWER
SCALE: 1/4" = 1'-0"



2 HOME DUGOUT - POWER
SCALE: 1/4" = 1'-0"

4' 2' 0' 4' 8'
SCALE : 1/4" = 1'-0"

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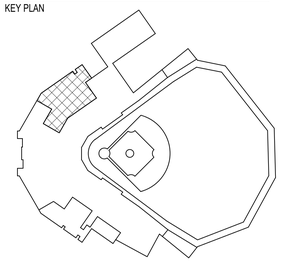

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B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

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SALISBURY, MD, 21804

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HOME & VISITOR DUGOUT PLANS - POWER

PHASE
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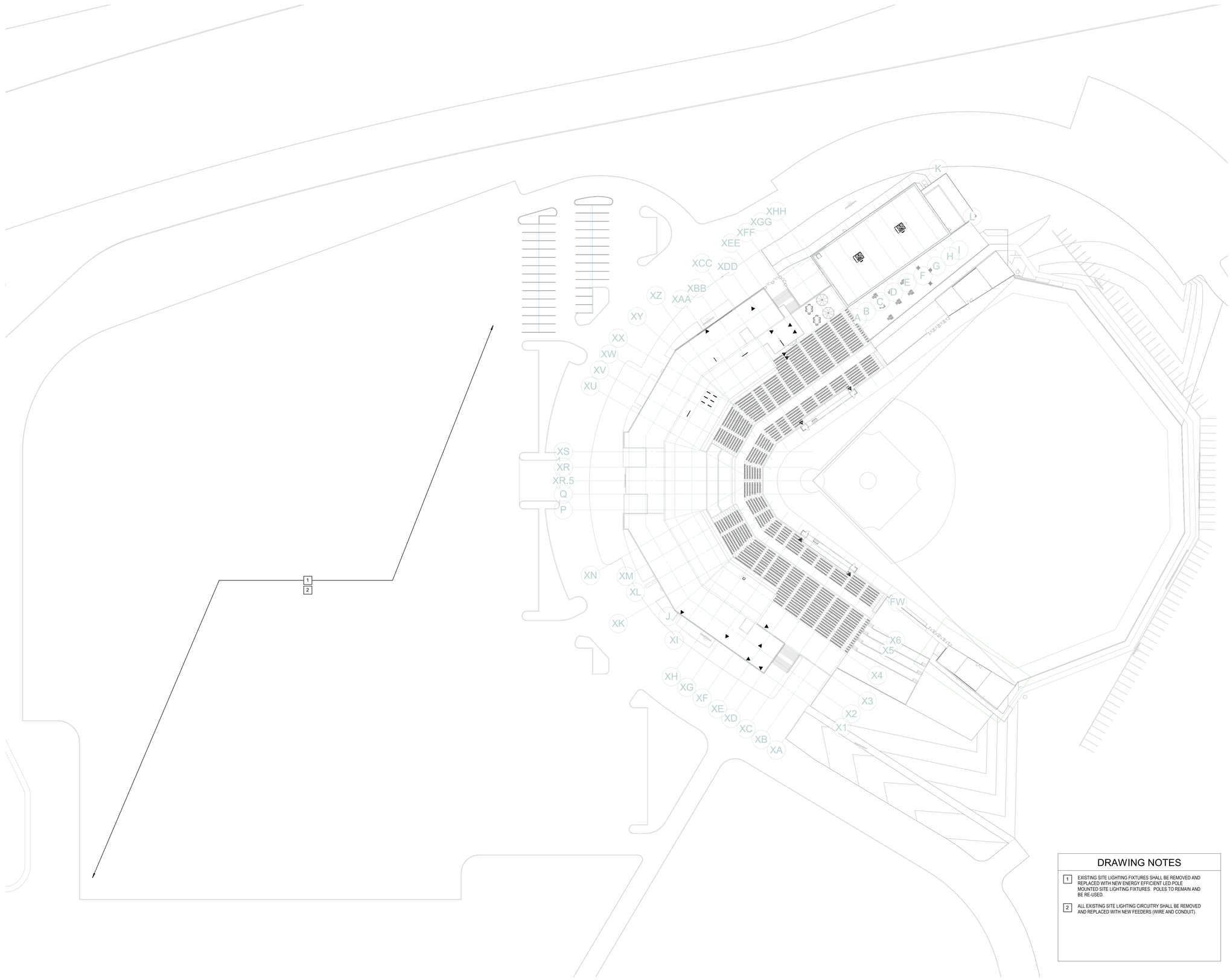

DRAWING NOTES

1. EXISTING SITE LIGHTING FIXTURES SHALL BE REMOVED AND REPLACED WITH NEW ENERGY EFFICIENT LED POLE MOUNTED SITE LIGHTING FIXTURES. POLES TO REMAIN AND BE RE-USED.
2. ALL EXISTING SITE LIGHTING CIRCUITRY SHALL BE REMOVED AND REPLACED WITH NEW FEEDERS (WIRE AND CONDUIT).

1 NEW WORK SITE PLAN - ELECTRICAL
SCALE: 1" = 40'-0"

40' 20' 0' 40' 80'
SCALE : 1" = 40'-0"

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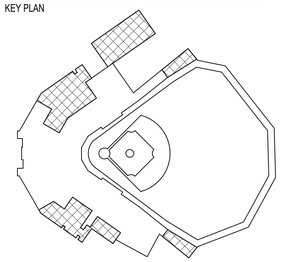

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EC/WFT PROJ NO. 20230573/23062 SCALE As indicated
DRAWING NAME
NEW WORK SITE PLAN - ELECTRICAL

PHASE CD
DRAWING NO. E1.1

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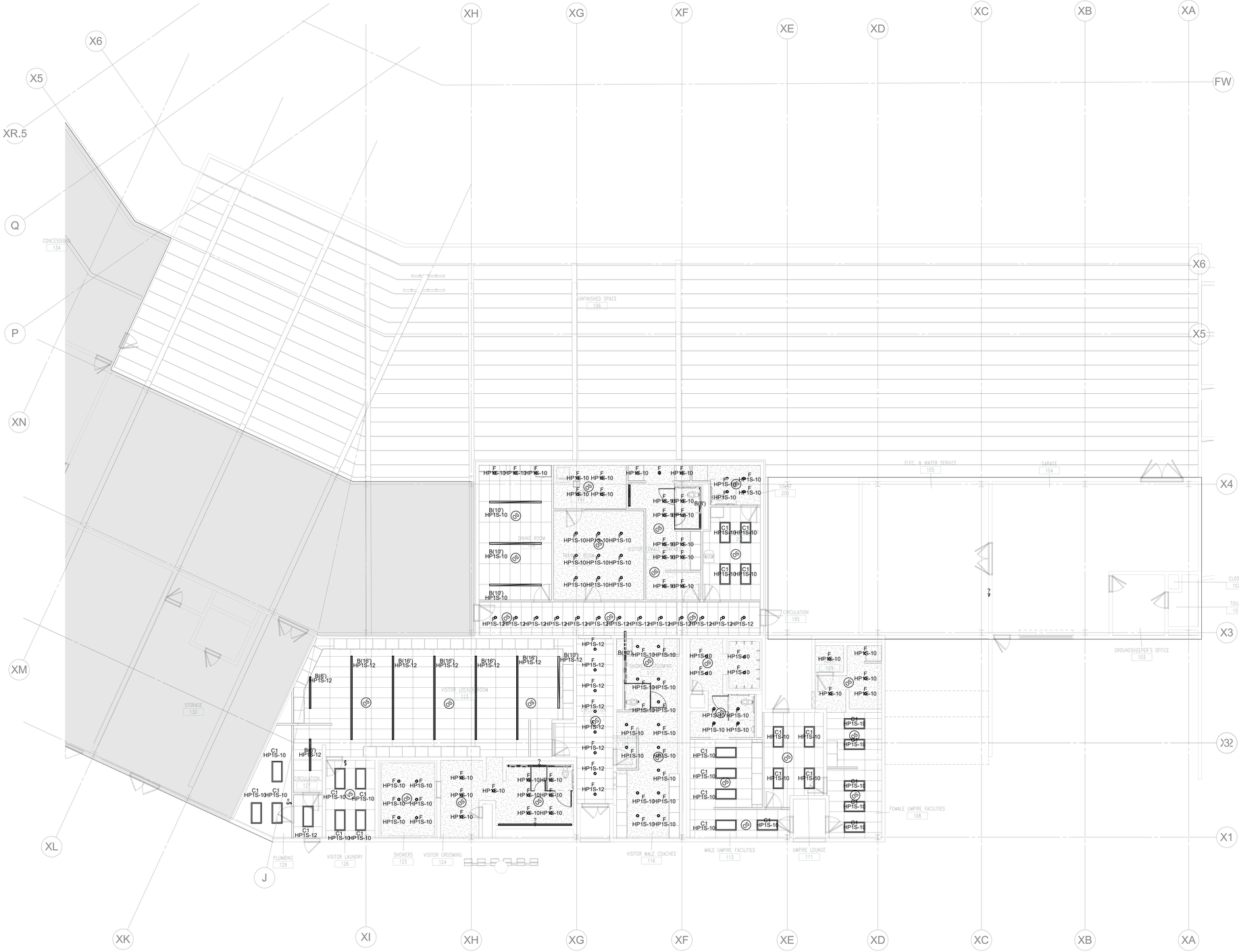

DRAWING NOTES

1. PLAN NOTE NUMBER 1
2. PLAN NOTE NUMBER 2
3. PLAN NOTE NUMBER 3
4. PLAN NOTE NUMBER 4
5. PLAN NOTE NUMBER 5

1 VISITOR CLUBHOUSE LIGHTING PLAN
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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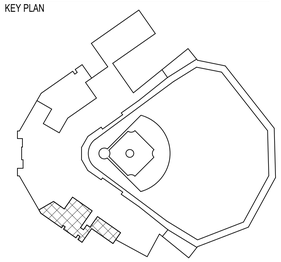

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

VISITOR CLUBHOUSE NEW WORK PLAN - LIGHTING

PHASE
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DRAWING NO.
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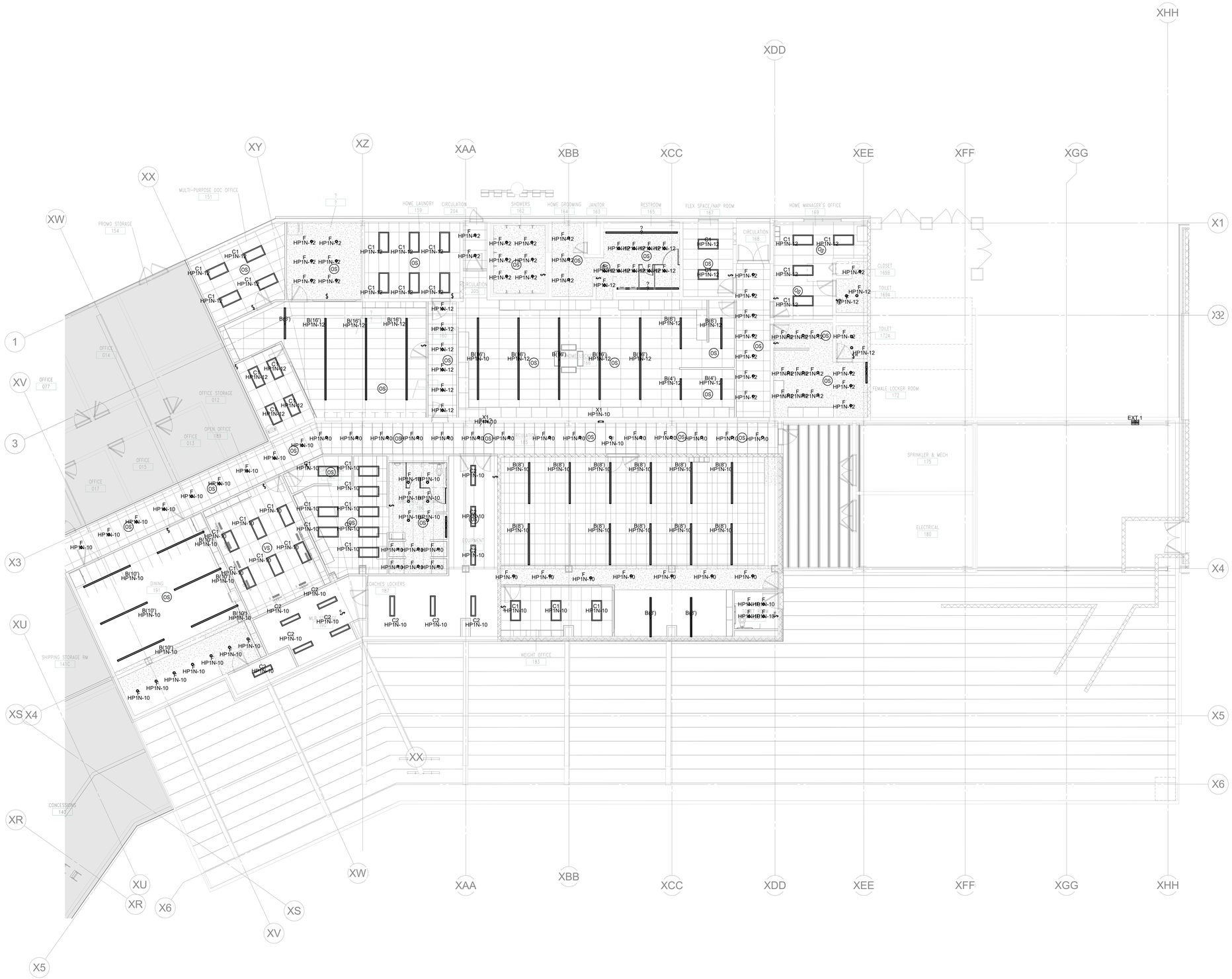

1 HOME CLUBHOUSE LIGHTING PLAN
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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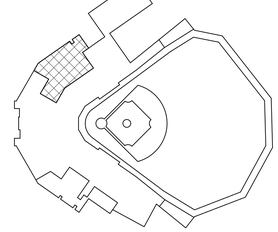

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DRAWING NAME
HOME CLUBHOUSE NEW WORK PLAN - LIGHTING

PHASE CD
DRAWING NO. E2.1.2

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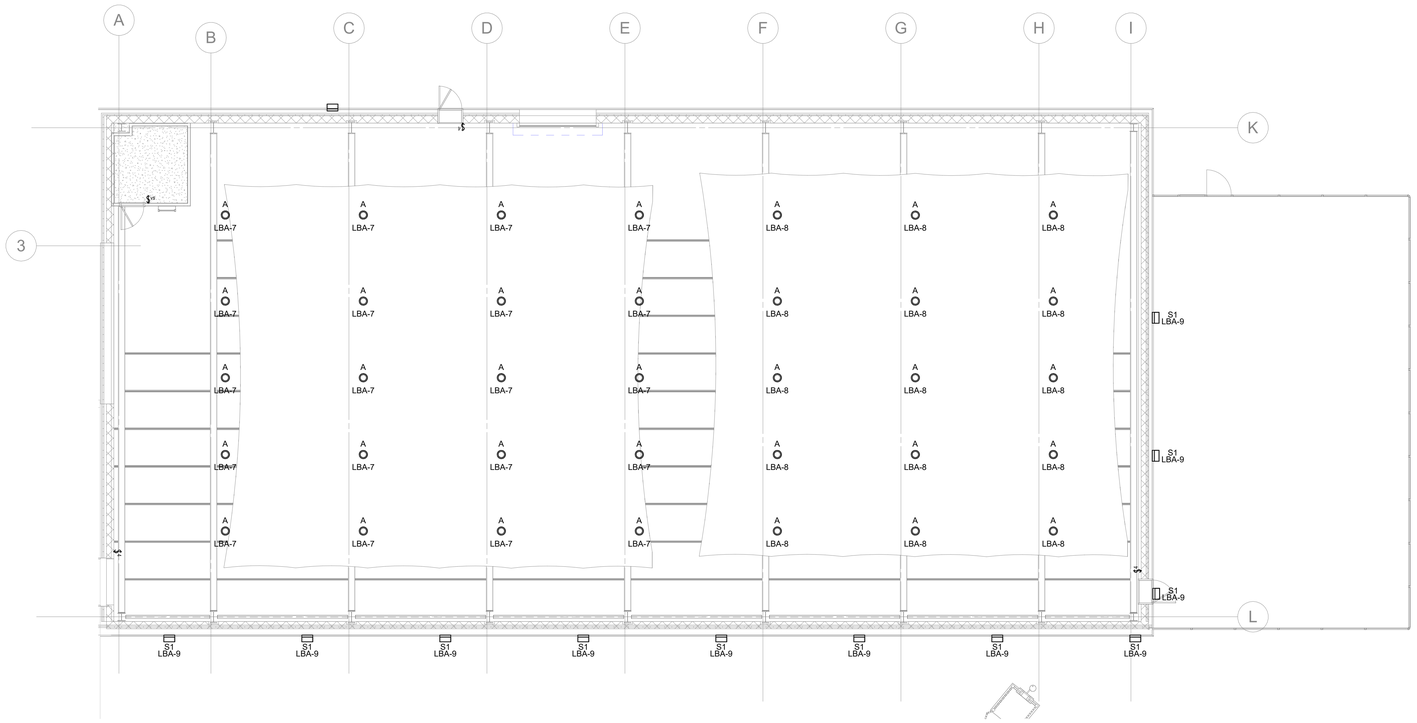

1 HOME CLUBHOUSE BATTING ARENA PLAN - LIGHTING

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE BATTING ARENA - LIGHTING

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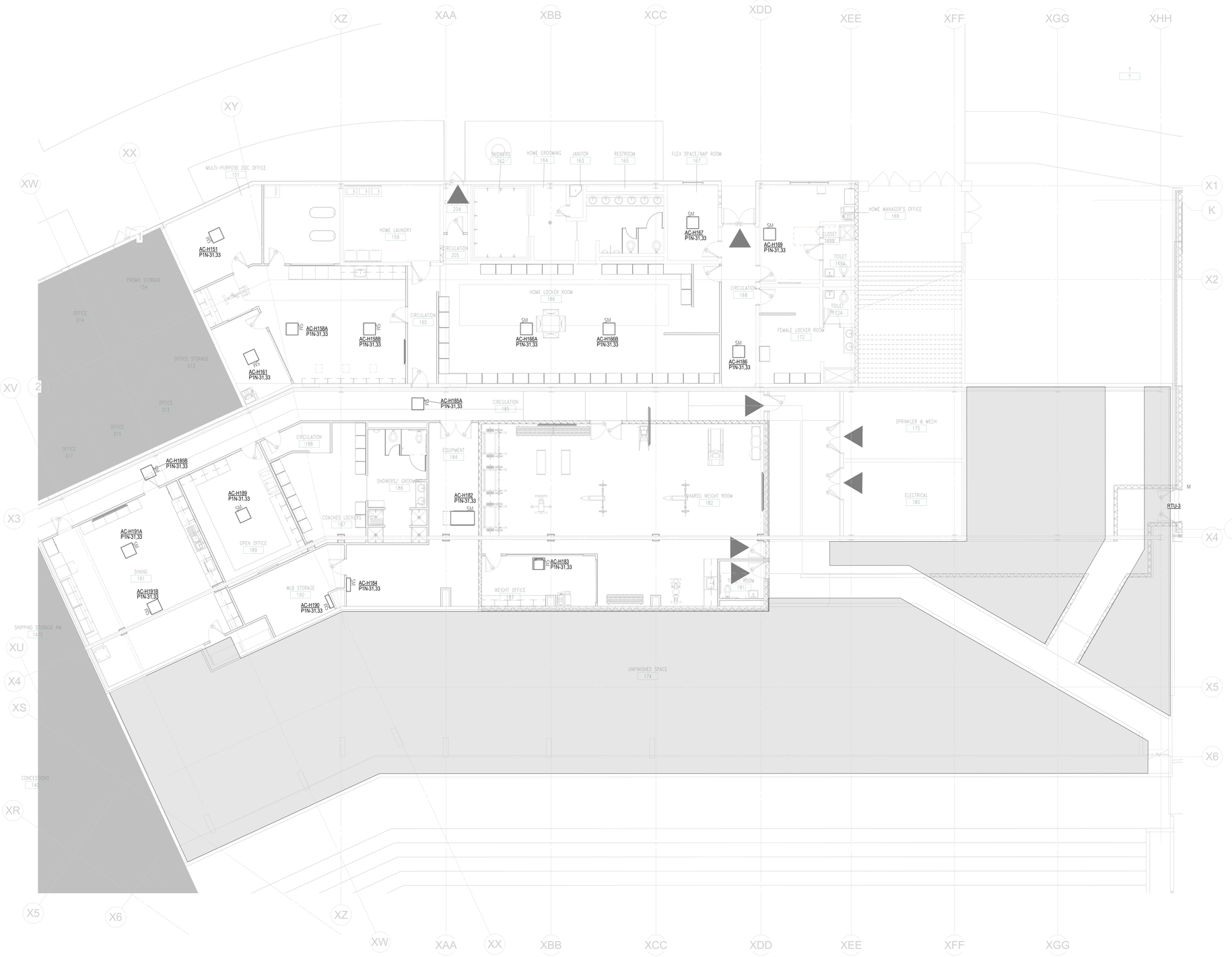

EQUIPMENT SCHEDULE

Equip ID	Equip Name	Apparent Load	Voltage	Phase	MOP	MCA
AC-H151	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H158A	CEILING CASSETTE	83 VA	208 V	1	15A	0.4
AC-H158B	CEILING CASSETTE	83 VA	208 V	1	15A	0.4
AC-H161	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H166A	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-H166B	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-H167	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H169	CEILING CASSETTE	83 VA	208 V	1	15A	0.4
AC-H182	MSP CONCEALED DUCTED UNIT	520 VA	208 V	1	15A	2.5
AC-H183	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H184	WALL MOUNTED UNIT	0 VA	208 V	1	15A	0.3
AC-H185A	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H185B	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H186	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-H189	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-H190	WALL MOUNTED UNIT	0 VA	208 V	1	15A	0.3
AC-H191A	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-H191B	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
EAC-2	ELECTRIC AIR CURTAIN	15040 VA	460 V	3	25A	18.9

1 HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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HOME CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER

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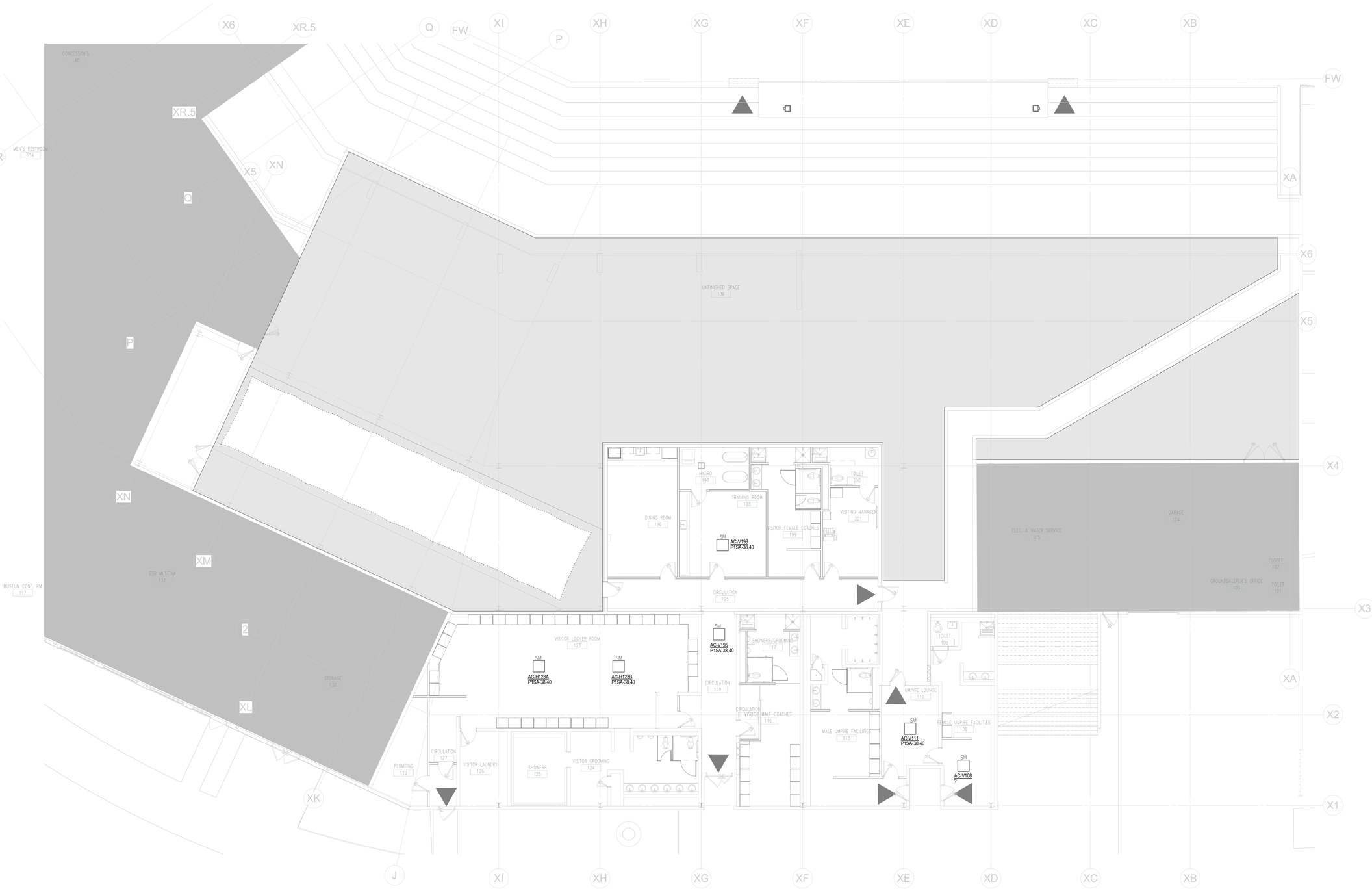

EQUIPMENT SCHEDULE						
Equip ID	Equip Name	Apparent Load	Voltage	Phase	MOP	MCA
AC-H123A	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-H123B	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-V108	CEILING CASSETTE	125 VA	208 V	1	15A	0.6
AC-V111	CEILING CASSETTE	62 VA	208 V	1	15A	0.3
AC-V195	CEILING CASSETTE	83 VA	208 V	1	15A	0.4
AC-V198	CEILING CASSETTE	62 VA	208 V	1	15A	0.3

1 VISITOR CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

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VISTOR CLUBHOUSE NEW WORK PLAN - MECHANICAL POWER

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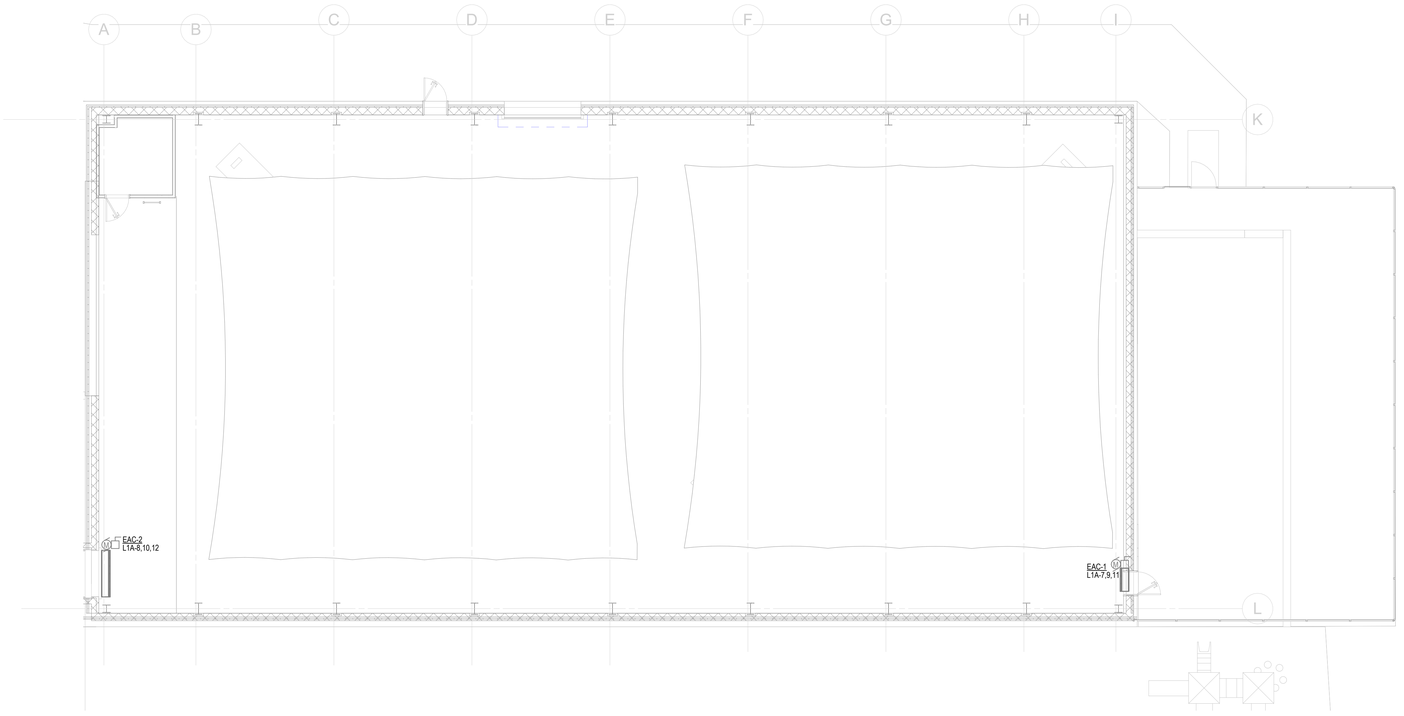
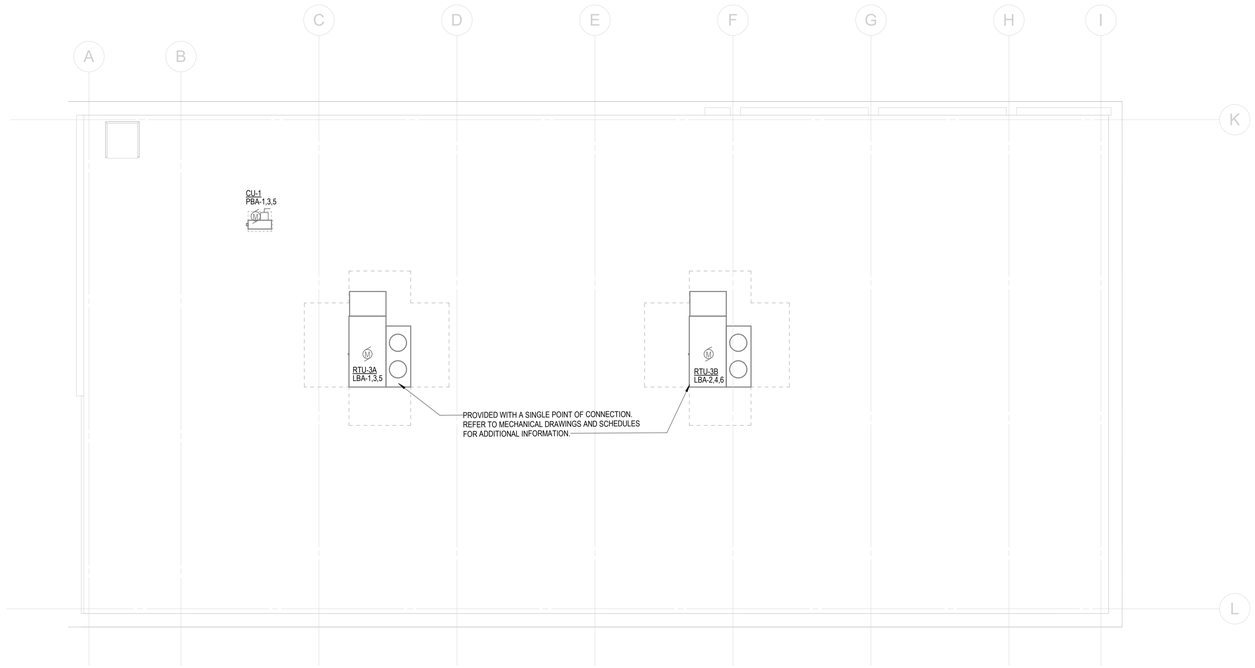


1 HOME CLUBHOUSE BATTING ARENA PLAN - MECHANICAL POWER

SCALE: 1/8" = 1'-0"

EQUIPMENT SCHEDULE						
Equip ID	Equip Name	Apparent Load	Voltage	Phase	MOP	MCA
CU-1	AIR COOLED HEAT PUMP	2254 VA	208 V	1	20A	13.55
EAC-1	ELECTRIC AIR CURTAIN	7878 VA	460 V	3	15A	9.9
EAC-2	ELECTRIC AIR CURTAIN	15040 VA	460 V	3	25A	18.9
RTU-3A	HEAT PUMP ROOFTOP UNIT	51364 VA	480 V	3	90	80.68
RTU-3B	HEAT PUMP ROOFTOP UNIT	51364 VA	480 V	3	90	80.68



2 BATTING ARENA ROOF - MECHANICAL POWER

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986

351 West Camden Street
Suite # 300
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Tel: 410-333 1560

EWING COLE

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KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

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B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE BATTING ARENA - MECHANICAL POWER

PHASE
CD

DRAWING NO.
E3.1.3

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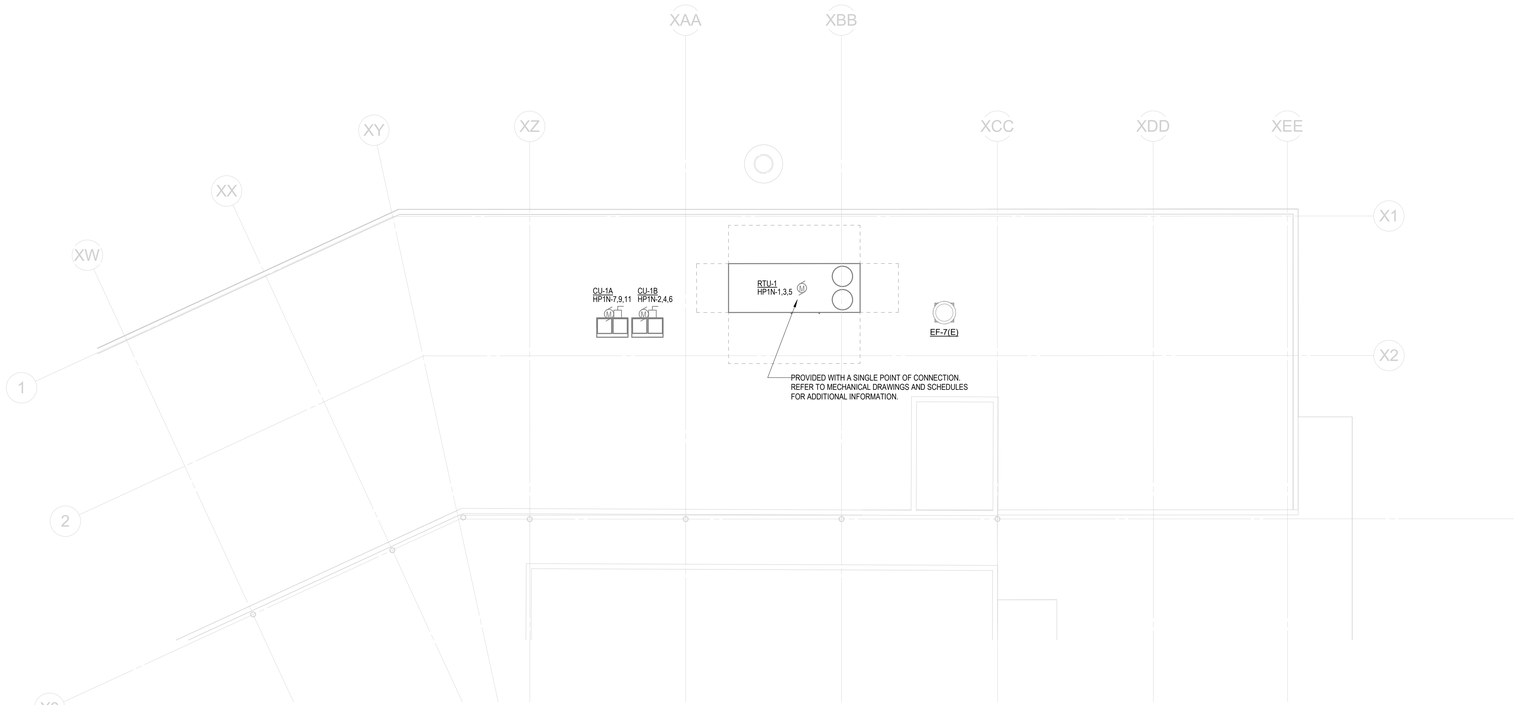
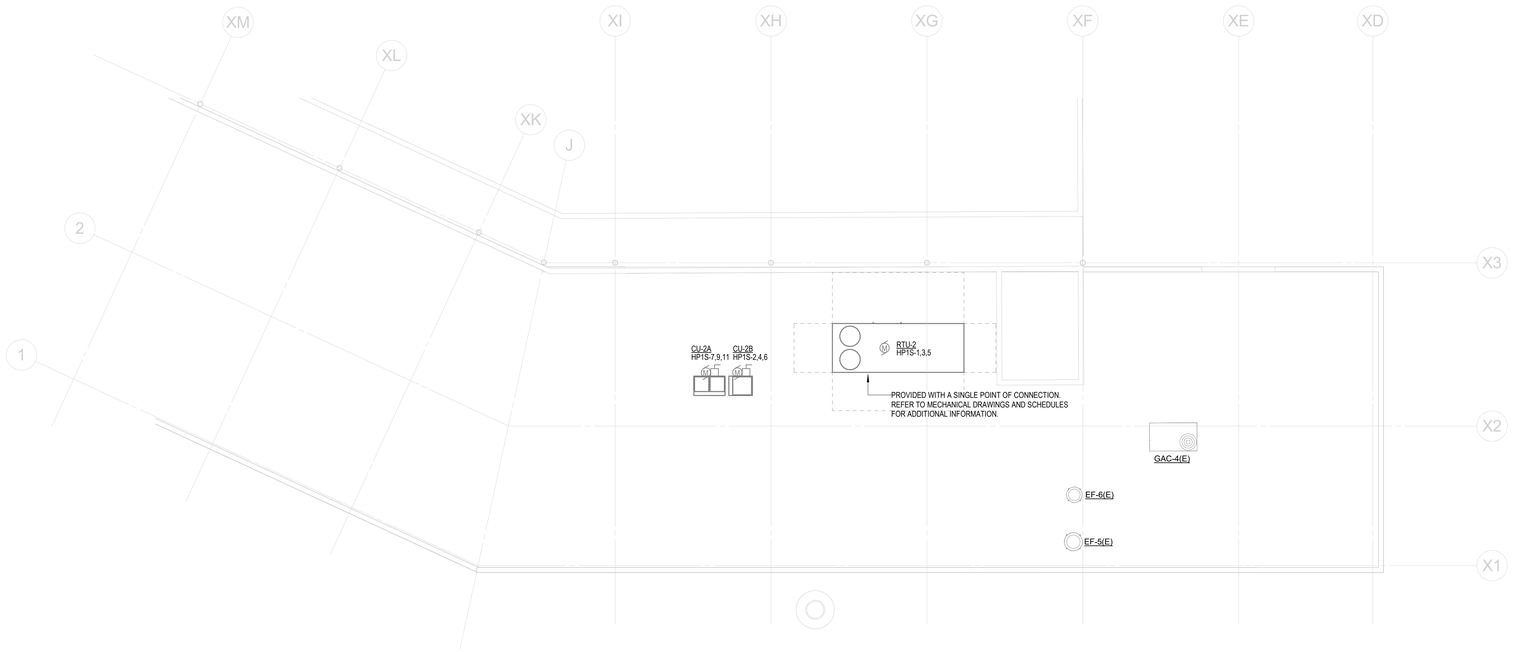


1 NEW CLUBHOUSE ROOF PLAN - HOME - MECHANICAL POWER

SCALE: 1/8" = 1'-0"



2 NEW CLUBHOUSE ROOF PLAN - VISITOR - MECHANICAL POWER

SCALE: 1/8" = 1'-0"

EQUIPMENT SCHEDULE

Equip ID	Equip Name	Apparent Load	Voltage	Phase	MOP	MCA
CU-1A	AIR COOLED HEAT PUMP	16393 VA	460 V	3	25A	20.6
CU-1B	AIR COOLED HEAT PUMP	16393 VA	460 V	3	25A	20.6
CU-2A	AIR COOLED HEAT PUMP	16393 VA	460 V	3	25A	20.6
CU-2B	AIR COOLED HEAT PUMP	9788 VA	460 V	3	25A	12.3
RTU-1	HEAT PUMP ROOFTOP UNIT	87728 VA	480 V	3	150A	137.8
RTU-2	HEAT PUMP ROOFTOP UNIT	78816 VA	480 V	3	125A	123.8

4' 2' 0' 4' 8'

SCALE : 1/4" = 1'-0"

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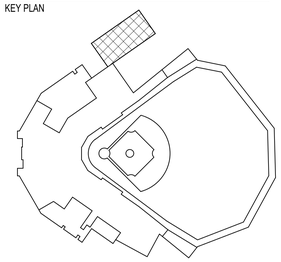
KEY PLAN



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DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

NEW CLUBHOUSE ROOF PLAN - MECHANICAL POWER

PHASE
CD

DRAWING NO.
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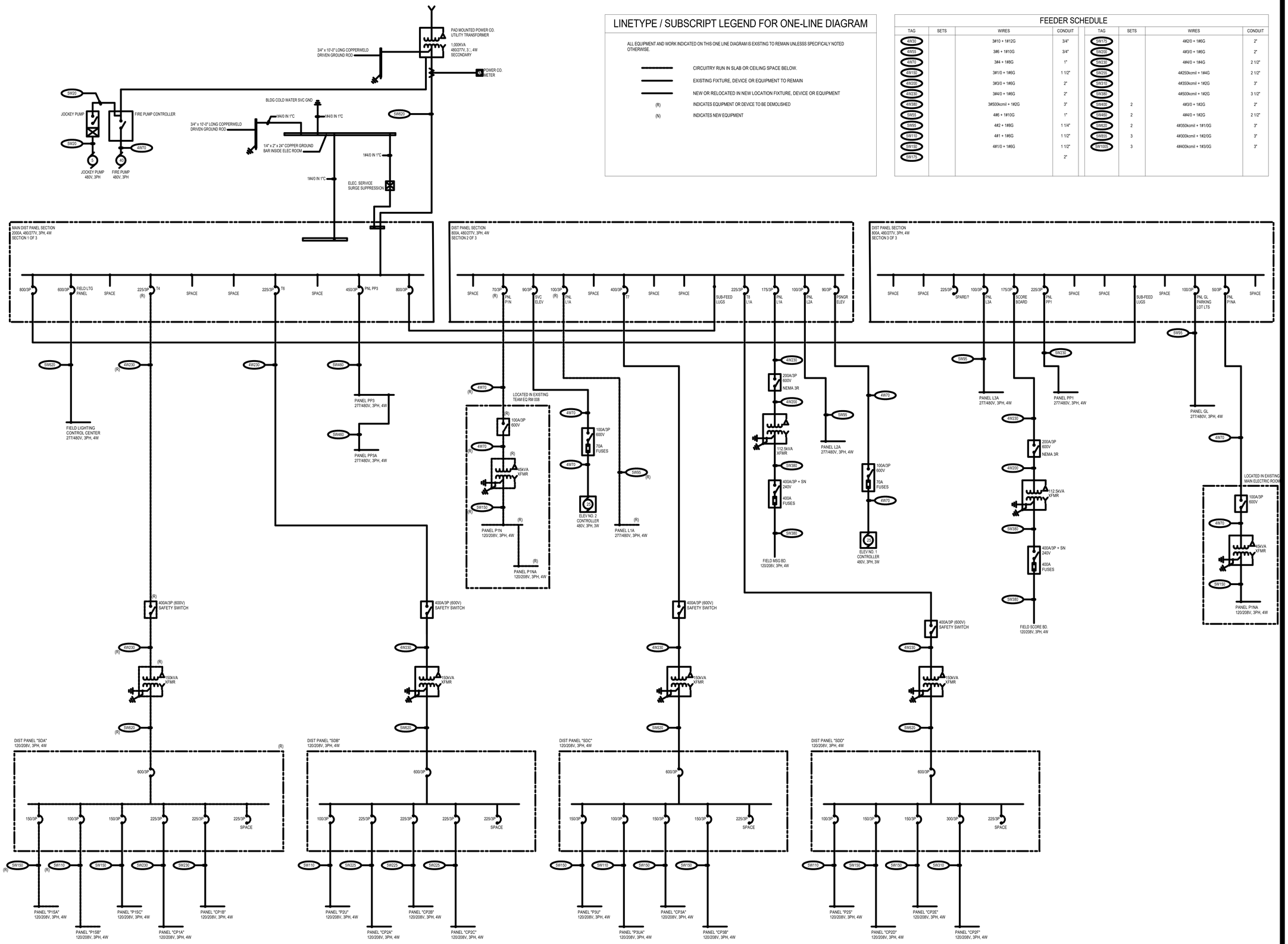
LINETYPE / SUBSCRIPT LEGEND FOR ONE-LINE DIAGRAM

ALL EQUIPMENT AND WORK INDICATED ON THIS ONE LINE DIAGRAM IS EXISTING TO REMAIN UNLESSS SPECIFICALY NOTED OTHERWISE.

———	CIRCUITRY RUN IN SLAB OR CEILING SPACE BELOW.
———	EXISTING FIXTURE, DEVICE OR EQUIPMENT TO REMAIN
———	NEW OR RELOCATED IN NEW LOCATION FIXTURE, DEVICE OR EQUIPMENT
(R)	INDICATES EQUIPMENT OR DEVICE TO BE DEMOLISHED
(N)	INDICATES NEW EQUIPMENT

FEEDER SCHEDULE

TAG	SETS	WIRES	CONDUIT	TAG	SETS	WIRES	CONDUIT
4W30		3#10 + 1#12G	3/4"	5W175		4#2/0 + 1#6G	2"
5W55		3#6 + 1#10G	3/4"	5W200		4#3/0 + 1#6G	2"
4W70		3#4 + 1#8G	1"	5W230		4#4/0 + 1#4G	2 1/2"
4W150		3#1/0 + 1#6G	1 1/2"	5W255		4#250kcmil + 1#4G	2 1/2"
4W200		3#3/0 + 1#6G	2"	5W310		4#350kcmil + 1#2G	3"
4W230		3#4/0 + 1#6G	2"	5W380		4#500kcmil + 1#2G	3 1/2"
4W380		3#500kcmil + 1#2G	3"	5W400	2	4#3/0 + 1#2G	2"
5W55		4#6 + 1#10G	1"	5W440	2	4#4/0 + 1#2G	2 1/2"
5W95		4#2 + 1#8G	1 1/4"	5W620	2	4#350kcmil + 1#1/0G	3"
5W110		4#1 + 1#6G	1 1/2"	5W825	3	4#300kcmil + 1#2/0G	3"
5W150		4#1/0 + 1#6G	1 1/2"	5W1005	3	4#400kcmil + 1#3/0G	3"
5W175			2"				



1 ONE-LINE EXISTING/DEMO
NOT TO SCALE

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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

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DRAWING NAME
ONE-LINE - DEMOLITION

PHASE CD
DRAWING NO. E5.1.1

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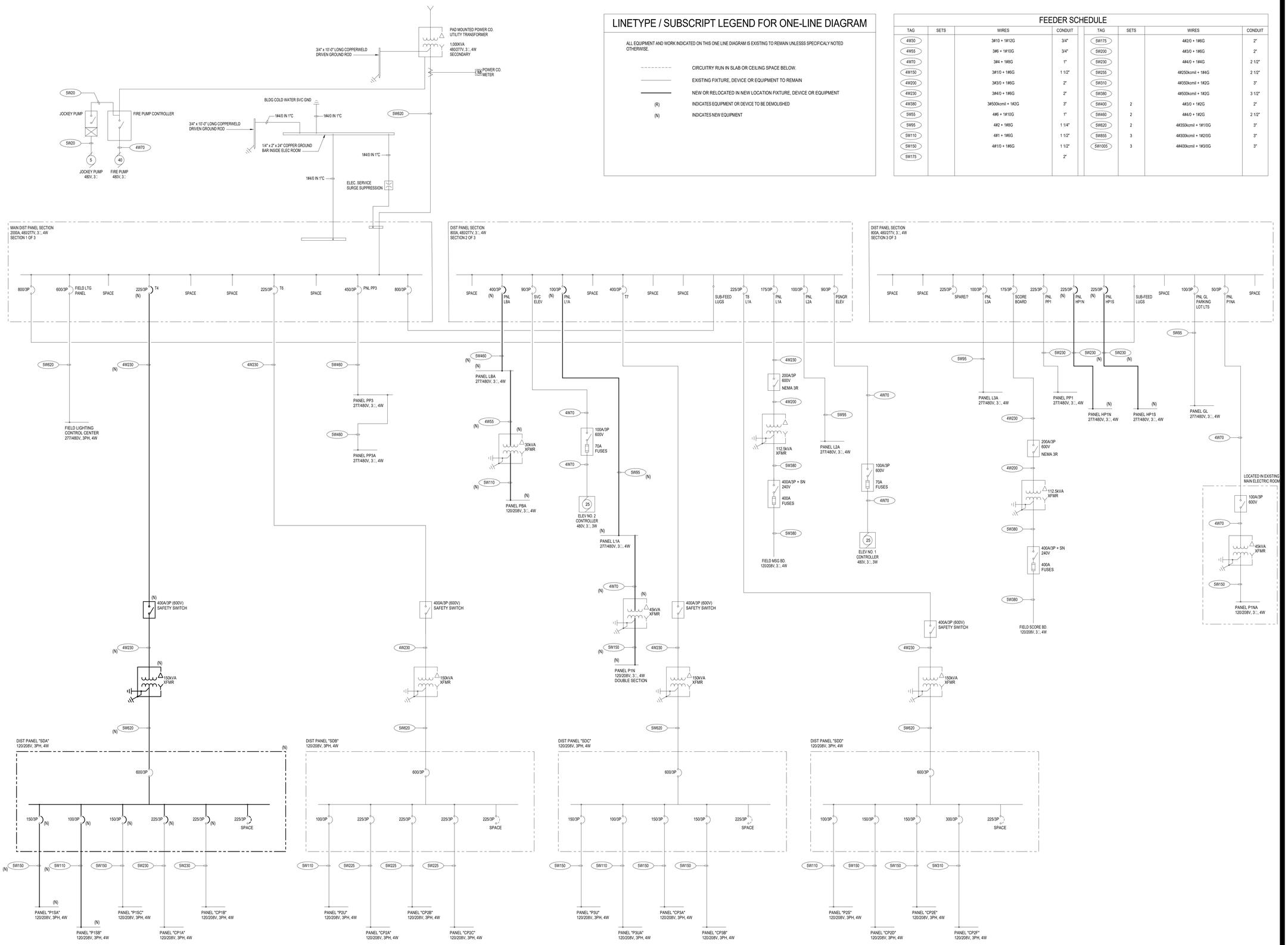

LINETYPE / SUBSCRIPT LEGEND FOR ONE-LINE DIAGRAM

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- NEW OR RELOCATED IN NEW LOCATION FIXTURE, DEVICE OR EQUIPMENT
- (R) INDICATES EQUIPMENT OR DEVICE TO BE DEMOLISHED
- (N) INDICATES NEW EQUIPMENT

FEEDER SCHEDULE

TAG	SETS	WIRES	CONDUIT	TAG	SETS	WIRES	CONDUIT
4W30		3#10 + 1#12G	3/4"	5W175		4#2/0 + 1#6G	2"
4W55		3#6 + 1#10G	3/4"	5W200		4#3/0 + 1#6G	2"
4W70		3#4 + 1#6G	1"	5W230		4#4/0 + 1#4G	2 1/2"
4W150		3#1/0 + 1#6G	1 1/2"	5W255		4#250kcmil + 1#4G	2 1/2"
4W200		3#3/0 + 1#6G	2"	5W310		4#350kcmil + 1#2G	3"
4W230		3#4/0 + 1#6G	2"	5W380		4#500kcmil + 1#2G	3 1/2"
4W380		3#500kcmil + 1#2G	3"	5W400	2	4#3/0 + 1#2G	2"
5W55		4#6 + 1#10G	1"	5W460	2	4#4/0 + 1#2G	2 1/2"
5W95		4#2 + 1#8G	1 1/4"	5W620	2	4#350kcmil + 1#1/0G	3"
5W110		4#1 + 1#6G	1 1/2"	5W855	3	4#300kcmil + 1#2/0G	3"
5W150		4#1/0 + 1#6G	1 1/2"	5W1005	3	4#400kcmil + 1#3/0G	3"
5W175			2"				

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ONE-LINE - NEW WORK

PHASE CD
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Branch Panel: HP1N

Location: | Supply From: | Enclosure: Type 1 | Mounting: Surface | Sections: | ISC Rating: | Voltage: 480/277 Wye | Phases: 3 | Wires: 4 | Bus Rating: 225 A | MLO/MCB: MLO | MCB Rating: 1 A | Double Lugged: | Feed Thru Lug: | ISO Ground Bus: | Neutral Bus: | Ground Bus: | Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1							29.24	5.46											2
3	RTU-1	HVAC	4#1/0 + 1#6G	1 1/2"	150 A	3			29.24	5.46			3	25 A	3/4"	4#10 + 1#12G	HVAC	CU-1B	4
5											29.24	5.46							6
7							5.46	0.50					1	20 A	3/4"	2#12+1#12G	Other	BULLPEN LIGHTING	8
9	CU-1A	HVAC	4#10 + 1#12G	3/4"	25 A	3			5.46	2.89			1	20 A			Lighting; Lighting -...	HOME LIGHTING	10
11											5.46	3.32	1	20 A			Lighting	HOME LIGHTING	12
13	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	14
15	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	16
17	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	18
19	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	20
21	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	22
23	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	24
25	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	26
27	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	28
29	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	30
31	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	32
33	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	34
35	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	36
37	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	38
39	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	40
41	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	42
					Total Load:		40.7 kVA		43.0 kVA		43.4 kVA								
					Total Amps:		147 A		156 A		158 A								

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	120514 VA	100.00%	120514 VA		
Lighting	6204 VA	125.00%	7755 VA	Total Conn. Load:	127.0 kVA
Other	500 VA	100.00%	500 VA	Total Est. Demand:	128.5 kVA
Lighting - Interior	6 VA	125.00%	8 VA	Total Conn. Current:	153 A
				Total Est. Demand Current:	155 A

Notes:

Branch Panel: L1A

Location: | Supply From: | Enclosure: Type 1 | Mounting: Surface | Sections: | ISC Rating: | Voltage: 480/277 Wye | Phases: 3 | Wires: 4 | Bus Rating: 125 A | MLO/MCB: MLO | MCB Rating: 125 A | Double Lugged: | Feed Thru Lug: | ISO Ground Bus: | Neutral Bus: | Ground Bus: | Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1							14.68	0.00					1	20 A	--	--	--	Spare	2
3	45kva for P1N	HVAC; Other; Spare; Receptacle	3#4 + 1#8G	1"	70 A	3			18.33	0.00			1	20 A	--	--	--	Spare	4
5											16.22	0.00	1	20 A	--	--	--	Spare	6
7							2.63	5.01											8
9	EAC-1	HVAC	4#12 + 1#12G	3/4"	15 A	3			2.63	5.01			3	25 A	3/4"	4#10 + 1#12G	HVAC	EAC-2	10
11											2.63	5.01							12
13	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	14
15	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	16
17	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	18
19	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	20
21	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	22
23	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	24
25	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	26
27	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	28
29	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	30
31	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	32
33	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	34
35	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	36
37	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	38
39	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	40
41	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	42
					Total Load:		22.3 kVA		26.0 kVA		23.9 kVA								
					Total Amps:		81 A		95 A		87 A								

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	22918 VA	100.00%	22918 VA		
Other	7200 VA	100.00%	7200 VA	Total Conn. Load:	72.1 kVA
Receptacle	42029 VA	61.90%	26015 VA	Total Est. Demand:	56.1 kVA
				Total Conn. Current:	87 A
				Total Est. Demand Current:	68 A

Notes:

Branch Panel: P1N

Location: | Supply From: | Enclosure: Type 1 | Mounting: Surface | Sections: | ISC Rating: | Voltage: 120/208 Wye | Phases: 3 | Wires: 4 | Bus Rating: 225 A | MLO/MCB: MCB | MCB Rating: 150 A | Double Lugged: | Feed Thru Lug: | ISO Ground Bus: | Neutral Bus: | Ground Bus: | Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1	DINING APPLIANCE	Receptacle	2#12+1#12G	3/4"	20 A	1	0.75	0.18					1	20 A	3/4"	2#12+1#12G	Receptacle	DINING APPLIANCE	2
3	WARMING CABINET	Receptacle	2#12+1#12G	3/4"	20 A	1			1.20	0.75			1	20 A	3/4"	2#12+1#12G	Receptacle	CATERING RECEPT	4
5	CATERING RECEPT	Receptacle	2#12+1#12G	3/4"	20 A	1					0.75	0.75	1	20 A	3/4"	2#12+1#12G	Receptacle	CATERING RECEPT	6
7	CATERING RECEPT	Receptacle	2#12+1#12G	3/4"	20 A	1	0.75	0.75					1	20 A	3/4"	2#12+1#12G	Receptacle	CATERING RECEPT	8
9	CATERING RECEPT	Receptacle	2#12+1#12G	3/4"	20 A	1			0.75	0.75			1	20 A	3/4"	2#12+1#12G	Receptacle	DINING APPLIANCE	10
11	DINING APPLIANCE	Receptacle	2#12+1#12G	3/4"	20 A	1					0.75	0.75	1	20 A	3/4"	2#12+1#12G	Receptacle	DINING APPLIANCE	12
13	DINING APPLIANCE	Receptacle	2#12+1#12G	3/4"	20 A	1	0.75	0.75					1	20 A	3/4"	2#12+1#12G	Receptacle	DINING APPLIANCE	14
15	RECEPTS 190, 191, CIRCULATION	Receptacle	2#12+1#12G	3/4"	20 A	1			1.08	0.60									16
17	COPIER - 189	Receptacle	2#12+1#12G	3/4"	20 A	1					0.18	0.60	3	30 A	3/4"	4#10+1#12G	Other	COPIER - 189	18
19	PC STATION - 189	Receptacle	2#12+1#12G	3/4"	20 A	1	0.72	0.60											20
21	PC STATION - 189	Receptacle	2#12+1#12G	3/4"	20 A	1			0.54	0.54			1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 189	22
23	PC STATION - 187	Receptacle	2#12+1#12G	3/4"	20 A	1					0.72	0.72	1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 187	24
25	PC STATION - 187	Receptacle	2#12+1#12G	3/4"	20 A	1	0.72	0.80					1	20 A	3/4"	2#12+1#12G	Receptacle	TV - 187, 191	26
27	RECEPTACLES - 184, 185, 186	Receptacle	2#12+1#12G	3/4"	20 A	1			0.90	1.08			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 182	28
29	RECEPTACLES - 182	Receptacle	2#12+1#12G	3/4"	20 A	1					1.08	0.90	1	20 A	3/4"	2#12+1#12G	Receptacle	USB RECEPTS - 182	30
31	HVAC UNITS	HVAC	2#12+1#12G	3/4"	15 A	2	0.00	0.36					1	20 A	3/4"	2#12+1#12G	Receptacle	TV - 169, 172	32
33									0.00	1.44			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 169, 172	34
35	PC STATIONS - 169	Receptacle	2#12+1#12G	3/4"	20 A	1					0.90	2.36	1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 166, 185	36
37	RECEPTACLES - 166, 167	Receptacle	2#12+1#12G	3/4"	20 A	1	2.04	1.08					1	20 A	3/4"	2#12+1#12G	Receptacle	USB RECEPTS - 166	38
39	USB RECEPTS - 166	Receptacle	2#12+1#12G	3/4"	20 A	1			1.08	1.26			1	20 A	3/4"	2#12+1#12G	Receptacle	USB RECEPTS - 166	40
41	USB RECEPTS - 166	Receptacle	2#12+1#12G	3/4"	20 A	1					1.26	1.26	1	20 A	3/4"	2#12+1#12G	Receptacle	USB RECEPTS - 166	42
43	CLG TV - 166	Receptacle	2#12+1#12G	3/4"	20 A	1	0.36	0.36					1	20 A	3/4"	2#12+1#12G	Receptacle	CLG TV - 166	44
45	RECEPTACLES - 158	Receptacle	2#12+1#12G	3/4"	20 A	1			0.72	0.72			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 158	46
47	GFI RECPTS - 158	Receptacle	2#12+1#12G	3/4"	20 A	1					0.54	0.36	1	20 A	3/4"	2#12+1#12G	Receptacle	GFI RECPTS - 158	48
49	TV - 158	Receptacle	2#12+1#12G	3/4"	20 A	1	0.36	0.36					1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATIONS	50
51	RECEPTACLES - 149, 151	Receptacle	2#12+1#12G	3/4"	20 A	1			1.44	0.60			1	20 A	3/4"	2#12+1#12G	Receptacle	ICE MACHINE - 149	52
53											0.60	0.60							54
55	ICE BATH - 149	Other	4#10+1#12G	3/4"	30 A	3	0.60	0.60					3	30 A	3/4"	4#10+1#12G	Other	ICE BATH - 149	56
57									0.60	0.60									58
59											0.60	0.18	1	20 A	3/4"	2#12+1#12G	Receptacle	COPIER - 151	60
61	COPIER - 151	Other	4#10+1#12G	3/4"	30 A	3	0.60	0.72					1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 172	62
63									0.60	0.72			1	20 A	3/4"	2#12+1#12G	Receptacle	GFI RECEPTS - 165	64
65	EF-1	HVAC	2#12+1#12G	3/4"	20 A	1					0.00	0.00	1	20 A	3/4"	2#12+1#12G	HVAC	EF-2	66
67	HOME DUGOUT RECEPTACLES	Receptacle			20 A	1	0.54	0.00					1	20 A	--	--	--	Spare	68
69	HOME DUGOUT RECEPTACLES	Receptacle			20 A	1			0.36	0.00			1	20 A	--	--	--	Spare	70
71	HOME BULLPEN RECEPTACLES	Receptacle			20 A	1					0.36	0.00	1	20 A	--	--	--	Spare	72
73	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	74
75	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	76
77	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	78
79	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	80
81	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	82
83	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	84
					Total Load:		14.7 kVA		18.3 kVA		16.2 kVA								
					Total Amps:		122 A		155 A		137 A								

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	0 VA	0.00%	0 VA		
Other	7200 VA	100.00%	7200 VA	Total Conn. Load:	49.2 kVA
Receptacle	42029 VA	61.90%	26015 VA	Total Est. Demand:	33.2 kVA
				Total Conn. Current:	137 A
				Total Est. Demand Current:	92 A

Notes:

Branch Panel: LBA

Location: | Supply From: | Enclosure: Type 1 | Mounting: Surface | Sections: | ISC Rating: | Voltage: 480/277 Wye | Phases: 3 | Wires: 4 | Bus Rating: 400 A | MLO/MCB: | MCB Rating: 400 A | Double Lugged: | Feed Thru Lug: | ISO Ground Bus: | Neutral Bus: | Ground Bus: | Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1									17.12	17.12									2
3	RTU-3A	HVAC	4#2 + 1#8G	1 1/4"	90 A	3			17.12	17.12			3	90 A	1 1/4"	4#2 + 1#8G	HVAC	RTU-3B	4
5											17.12	17.12							6
7	BATTING ARENA LIGHTING	Lighting	2#12+1#12G	3/4"	20 A	1	2.04	1.53					1	20 A	3/4"	2#12+1#12G	Lighting	BATTING ARENA LIGHTING	8
9	BATTING ARENA EXTERIOR LTG	Lighting; Lighting -...	2#12+1#12G	3/4"	20 A	1			0.15	0.00			1	20 A	--	--	--	Spare	10
11	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	12
13	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	14
15	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	16
17	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	18
19	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	20
21	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	22
23	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	24
25	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	26
27	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	28
29	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	30
31	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	32
33	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	34
35	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	36
37	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	38
39	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	40
41	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	42
					Total Load:		37.8 kVA		34.4 kVA		34.2 kVA								
					Total Amps:		137 A		124 A		124 A								

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	102728 VA	100.00%	102728 VA		
Lighting	3570 VA	125.00%	4463 VA	Total Conn. Load:	106.4 kVA
Lighting - Exterior	154 VA	125.00%	193 VA	Total Est. Demand:	107.4 kVA
				Total Conn. Current:	128 A
				Total Est. Demand Current:	129 A

Notes:

Branch Panel: PBA

Location: | Supply From: | Enclosure: Type 1 | Mounting: Surface | Sections: | ISC Rating: | Voltage: 120/208 Wye | Phases: 3 | Wires: 4 | Bus Rating: 100 A | MLO/MCB: MCB | MCB Rating: 100 A | Double Lugged: | Feed Thru Lug: | ISO Ground Bus: | Neutral Bus: | Ground Bus: | Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1							0.75	0.36					1	20 A		2#12 + 1#12G	Receptacle	TV - BATTING ARENA	2
3	HVAC	HVAC	4#12 + 1#12G	3/4"	20 A	3			0.75	0.54			1	20 A		2#12 + 1#12G	Receptacle	RECEPTS - BA ELECTRIC RM	4
5											0.75	0.50	1	20 A		2#12 + 1#12G	Other	PITCHING MACHINE	6
7	PITCHING MACHINE	Other	2#12 + 1#12G	3/4"	20 A	1	0.50	0.50					1	20 A		2#12 + 1#12G	Other	PITCHING MACHINE	8
9	PITCHING MACHINE	Other	2#12 + 1#12G	3/4"	20 A	1			0.50	1.08			1	20 A		2#12 + 1#12G	Receptacle	RECEPTACLES - BATTING ARENA	10
11	TV - BATTING ARENA	Receptacle	2#12 + 1#12G	3/4"	20 A	1					0.36	1.26	1	20 A		2#12 + 1#12G	Receptacle	RECEPTACLES - BATTING ARENA	12
13	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	14
15	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	16
17	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	18
19	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	20
21	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	22
23	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	24
25	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	26
27	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	28
29	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	30
31	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	32
33	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	34
35	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	36
37	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	38
39	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	40
41	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	42
					Total Load:		2.1 kVA		2.9 kVA		2.9 kVA								
					Total Amps:		18 A		25 A		25 A								

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	2254 VA	100.00%	2254 VA		
Other	2000 VA	100.00%	2000 VA	Total Conn. Load:	7.9 kVA
Receptacle	3600 VA	100.00%	3600 VA	Total Est. Demand:	7.9 kVA
				Total Conn. Current:	22 A
				Total Est. Demand Current:	22 A

Notes:

MARYLAND STADIUM AUTHORITY Est. 1986

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

810 Light Street
Baltimore, MD 21230-3970
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Gilbane

The Liberty Building at McHenry Row
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STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	WFT	ISSUE 4: CONSTRUCTION DOCUMENTS	6/21/24
B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE NO SCALE

DRAWING NAME

PANEL SCHEDULES

PHASE CD

DRAWING NO. E7.1.1

2024-06-26 1:55:32 PM D:\Revit Documents-Backups\23062 Perdue Stadium MEP_(R24)_carsyd@ewfeng.com.rvt

Switchboard: SDA

Location: CONCESSIONS COLD...
Supply From: 150 kVA, 277 V/480 V, Three...
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating:
Mains Type:
Mains Rating: 600 A
MCB Rating: 600 A

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	PANEL P1SA	3	400 A	150 A	31222 VA	
2	PANEL P1SB	3	400 A	100 A	1620 VA	
3	(E)PANEL P1SC	3	400 A	150 A	15000 VA	
4	(E)PANEL CP1A	3	400 A	225 A	15000 VA	
5	(E)PANEL CP1B	3	400 A	225 A	24000 VA	
6	Spare	1	400 A	150 A	0 VA	
7	Space	1	--	--	--	
8	Space	1	--	--	--	
9	Space	1	--	--	--	
10	Space	1	--	--	--	
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
				Total Conn. Load:	86841 VA	
				Total Amps:	241 A	

Legend:
See one-line diagram for feeder sizes.

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	0 VA	0.00%	0 VA		
Motor	144 VA	100.00%	144 VA	**Total Conn. Load:**	86841 VA
Other	60250 VA	100.00%	60250 VA	**Total Est. Demand:**	79367 VA
Receptacle	22698 VA	72.03%	16349 VA	**Total Conn. Current:**	241 A
Kitchen Equipment - Non-Dwelling Unit	3750 VA	70.00%	2625 VA	**Total Est. Demand Current:**	220 A

Notes:

Branch Panel: HP1S

Location:
Supply From:
Enclosure: Type 1

Mounting: Surface
Sections:
ISC Rating:

Voltage: 480/277 Wye
Phases: 3
Wires: 4

Bus Rating: 225 A
MLO/MCB: MLO
MCB Rating: 1 A

Double Lugged:
Feed Thru Lug:
ISO Ground Bus:

Neutral Bus:
Ground Bus:
Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1							26.27	3.26											2
3	RTU-2	HVAC	4#1 + 1#6G	1 1/2"	125 A	3			26.27	3.26			3	25 A	3/4"	4#10 + 1#12G	HVAC	CU-2B	4
5											26.27	3.26							6
7							5.46	1.00					1	20 A	3/4"	2#12+1#12G	Lighting	BULLPEN LIGHTING	8
9	CU-2A	HVAC	4#10 + 1#12G	3/4"	25 A	3			5.46	3.32			1	20 A	3/4"	2#12+1#12G	Lighting	VISITORS LIGHTING	10
11											5.46	1.48	1	20 A	3/4"	2#12+1#12G	Lighting	VISITORS LIGHTING	12
13	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	14
15	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	16
17	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	18
19	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	20
21	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	22
23	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	24
25	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	26
27	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	28
29	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	30
31	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	32
33	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	34
35	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	36
37	Spare	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	Spare	38
39	Spare	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	Spare	40
41	Spare	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	Spare	42
							Total Load:		36.0 kVA		38.2 kVA		36.4 kVA						
							Total Amps:		130 A		138 A		132 A						

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	104997 VA	100.00%	104997 VA		
Lighting	5764 VA	125.00%	7205 VA	**Total Conn. Load:**	110.6 kVA
				Total Est. Demand:	112.0 kVA
				Total Conn. Current:	133 A
				Total Est. Demand Current:	135 A

Notes:

Branch Panel: P1SA

Location:
Supply From: SDA
Enclosure: Type 1

Mounting: Surface
Sections:
ISC Rating:

Voltage: 120/208 Wye
Phases: 3
Wires: 4

Bus Rating: 225 A
MLO/MCB: MCB
MCB Rating: 150 A

Double Lugged:
Feed Thru Lug:
ISO Ground Bus:

Neutral Bus:
Ground Bus:
Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1							0.83	0.83											2
3	HYDRO RECEPTACLE	Other	4#10+1#10G	3/4"	30 A	3			0.83	0.83			3	30 A	3/4"	4#10+1#10G	Other	HYDRO RECEPTACLE	4
5											0.83	0.83							6
7	DINING APPLIANCE	Kitchen Equipment -...	2#12+1#12G	3/4"	20 A	1	1.50	0.90					1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 196	8
9	DINING APPLIANCE	Kitchen Equipment -...	2#12+1#12G	3/4"	20 A	1			1.50	0.75			1	20 A	3/4"	2#12+1#12G	Other	HYDRO RECEPTACLE	10
11	DINING APPLIANCE	Kitchen Equipment -...	2#12+1#12G	3/4"	20 A	1					0.75	1.26	1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 197, 198	12
13	TV RECEPTACLES	Receptacle	2#12+1#12G	3/4"	20 A	1	0.50	1.50					1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 198	14
15	RECEPTACLES - 198,199,201	Receptacle	2#12+1#12G	3/4"	20 A	1			1.08	1.50			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 198	16
17	PC STATION - 199	Receptacle	2#12+1#12G	3/4"	20 A	1					0.75	0.75	1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLE - 198	18
19	RECEPTACLES - 117	Receptacle	2#12+1#12G	3/4"	20 A	1	0.36	0.50					1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 201	20
21	RECEPTACLES - 121	Receptacle	2#12+1#12G	3/4"	20 A	1			0.36	0.54			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 199,200	22
23	RECEPTACLES - 113	Receptacle	2#12+1#12G	3/4"	20 A	1					0.36	1.26	1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 120, 195	24
25	RECEPTACLES - 108,111,113	Receptacle	2#12+1#12G	3/4"	20 A	1	0.90	1.00					1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 108,113	26
27	TV RECEPTACLES - 108,111	Receptacle	2#12+1#12G	3/4"	20 A	1			0.50	1.00			1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION - 113,116	28
29	TV RECEPTACLES - 113,116	Receptacle	2#12+1#12G	3/4"	20 A	1					0.43	1.00	1	20 A	3/4"	2#12+1#12G	Receptacle	PC STATION- 116	30
31	RECEPTACLES - 124	Receptacle	2#12+1#12G	3/4"	20 A	1	0.36	0.43					1	20 A	3/4"	2#12+1#12G	Receptacle	TV RECEPTACLES - 123	32
33	RECEPTACLES - 124	Receptacle	2#12+1#12G	3/4"	20 A	1			0.36	0.72			1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 123	34
35	PC STATION - 116	Receptacle	2#12+1#12G	3/4"	20 A	1					1.00	0.72	1	20 A	3/4"	2#12+1#12G	Receptacle	RECEPTACLES - 123,127	36
37	USB RECEPTACLES - 123	Receptacle	2#12+1#12G	3/4"	20 A	1	1.08	0.07											38
39	EF-3	HVAC	2#12+1#12G	3/4"	20 A	1			0.00	0.07			2	15 A	3/4"	2#12+1#12G	HVAC	HVAC UNITS	40
41	EF-4	HVAC	2#12+1#12G	3/4"	20 A	1					0.00	0.50	1	20 A	3/4"	2#12+1#12G	Other	COOLER - 123	42
							Total Load:		10.7 kVA		10.0 kVA		10.4 kVA						
							Total Amps:		90 A		84 A		88 A						

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
HVAC	0 VA	0.00%	0 VA		
Motor	144 VA	100.00%	144 VA	**Total Conn. Load:**	31.2 kVA
Other	6250 VA	100.00%	6250 VA	**Total Est. Demand:**	24.6 kVA
Receptacle	21078 VA	73.72%	15539 VA	**Total Conn. Current:**	87 A
Kitchen Equipment - Non-Dwelling Unit	3750 VA	70.00%	2625 VA	**Total Est. Demand Current:**	68 A

Notes:

Branch Panel: P1SB

Location:
Supply From: SDA
Enclosure: Type 1

Mounting: Surface
Sections:
ISC Rating:

Voltage: 120/208 Wye
Phases: 3
Wires: 4

Bus Rating: 100 A
MLO/MCB: MCB
MCB Rating: 100 A

Double Lugged:
Feed Thru Lug:
ISO Ground Bus:

Neutral Bus:
Ground Bus:
Neutral Rating:

CKT	Circuit Description	Load Classification	Feeder	Conduit	Trip	P	A		B		C		P	Trip	Conduit	Feeder	Load Classification	Circuit Description	CKT
1	VISITOR BP - RECEPTACLES	Receptacle	2#12 + 1#12G	3/4"	20 A	1	0.36	0.54					1	20 A	3/4"	2#12 + 1#12G	Receptacle	VISITOR DUGOUT RECEPTACLES	2
3	VISITOR DUGOUT RECEPTACLES	Receptacle	2#12 + 1#12G	3/4"	20 A	1			0.36	0.36			1	20 A	3/4"	2#12 + 1#12G	Receptacle	GFI RECEPTS - 133	4
5	SPARE	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	SPARE	6
7	SPARE	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	SPARE	8
9	SPARE	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	SPARE	10
11	SPARE	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	SPARE	12
13	SPARE	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	SPARE	14
15	SPARE	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	SPARE	16
17	SPARE	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	SPARE	18
19	SPARE	--	--	--	20 A	1	0.00	0.00					1	20 A	--	--	--	SPARE	20
21	SPARE	--	--	--	20 A	1			0.00	0.00			1	20 A	--	--	--	SPARE	22
23	SPACE	--	--	--	20 A	1					0.00	0.00	1	20 A	--	--	--	SPARE	24
25	SPACE	--	--	--	--	1	--	--					1	--	--	--	--	SPACE	26
27	SPACE	--	--	--	--	1			--	--			1	--	--	--	--	SPACE	28
29	SPACE	--	--	--	--	1					--	--	1	--	--	--	--	SPACE	30
31	SPACE	--	--	--	--	1	--	--					1	--	--	--	--	SPACE	32
33	SPACE	--	--	--	--	1			--	--			1	--	--	--	--	SPACE	34
35	SPACE	--	--	--	--	1					--	--	1	--	--	--	--	SPACE	36
37	SPACE	--	--	--	--	1	--	--					1	--	--	--	--	SPACE	38
39	SPACE	--	--	--	--	1			--	--			1	--	--	--	--	SPACE	40
41	SPACE	--	--	--	--	1					--	--	1	--	--	--	--	SPACE	42
							Total Load:		0.9 kVA		0.7 kVA		0.0 kVA						
							Total Amps:		8 A		7 A		0 A						

Load Classification	Connected Load (VA)	Demand Factor	Estimated Demand	Panel Totals	
Receptacle	1620 VA	100.00%	1620 VA		
				Total Conn. Load:	1.6 kVA
				Total Est. Demand:	1.6 kVA
				Total Conn. Current:	4 A
				Total Est. Demand Current:	4 A

Notes:

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B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

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DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE NO SCALE

DRAWING NAME

PANEL SCHEDULES

PHASE CD

DRAWING NO. E7.1.2

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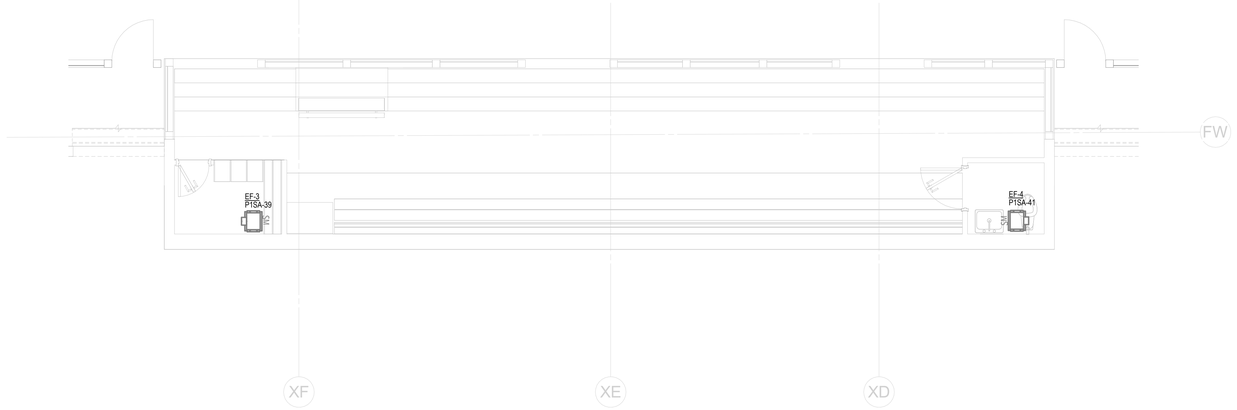

1 VISITOR DUGOUT - MECHANICAL POWER
SCALE: 1/4" = 1'-0"

EQUIPMENT SCHEDULE

Equip ID	Equip Name	Apparent Load	Voltage	Phase	MOP	MCA
EF-1	EXHAUST FAN	1200 VA	120 V	1	20A	
EF-2	EXHAUST FAN	1200 VA	120 V	1	20A	
EF-3	EXHAUST FAN	1200 VA	120 V	1	20A	
EF-4	EXHAUST FAN	1200 VA	120 V	1	20A	

2 HOME DUGOUT - MECHANICAL POWER
SCALE: 1/4" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"
DRAWING NAME
HOME & VISITOR DUGOUT PLANS - MECHANICAL POWER

PHASE CD
DRAWING NO. E.3.1.5

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LOW VOLTAGE SYSTEMS SYMBOL LEGEND

SYMBOL:	DESCRIPTION:	BACKBOX:	CONDUITS:	MOUNTING HEIGHT:	ELECTRONICS:	TELECOM CABLE:	POWER REQUIREMENTS:
L	CEILING RECESSED LOUDSPEAKER	CUSTOM BACK BOX	N/A	CEILING RECESSED	LOUDSPEAKER	N/A	N/A
L	WALL MOUNTED LOUDSPEAKER	2-GANG BOX	N/A	80" AFF	LOUDSPEAKER	N/A	N/A
DS	DIGITAL SIGNAGE DISPLAY	FSR PWB-100	ONE (1) 1-1/4" EC	60" AFF, U.N.O.	FLAT PANEL DISPLAY	ONE (1) CATEGORY CABLE	120VAC DUPLEX RECEPTACLE
D	WALL MOUNTED FLAT PANEL DISPLAY	FSR PWB-100	TWO (2) 1-1/4" EC	60" AFF, U.N.O.	FLAT PANEL DISPLAY	ONE (1) CATEGORY CABLE & ONE (1) RG-6 COAX CABLE	120VAC DUPLEX RECEPTACLE
D	CEILING POLE MOUNTED FLAT PANEL DISPLAY	2-GANG BOX WITH TRIM RING	ONE (1) 1-1/4" EC	CEILING POLE MOUNTED	FLAT PANEL DISPLAY	ONE (1) CATEGORY CABLE & ONE (1) RG-6 COAX CABLE	120VAC DUPLEX RECEPTACLE
C	WALL MOUNTED VIDEO CAMERA	2-GANG BOX	N/A	60" AFF	VIDEO CAMERA	N/A	REMOTE LOW VOLTAGE POWER
5	5-GANG MULTI-MEDIA WALLBOX	5-GANG BOX	THREE (3) 1-1/4" EC	OUTLET HEIGHT	N/A	N/A	N/A
CP	REMOTE CONTROL TOUCH PANEL	2-GANG BOX	ONE (1) 1" EC	SWITCH HEIGHT	REMOTE CONTROL TOUCH PANEL	ONE (1) CATEGORY CABLE	REMOTE LOW VOLTAGE POWER
AV	AUDIOVISUAL EQUIPMENT RACK	N/A	N/A	ON FLOOR	SEE AV SIGNAL FLOW	N/A	(2) DEDICATED 20-AMP,120V CIRCUITS W/ DUPLEX RECEPTACLE
X	STANDARD TELECOMMUNICATION OUTLET	2-GANG BOX WITH TRIM RING	N/A	OUTLET HEIGHT	N/A	"X" CATEGORY CABLES (TO TELECOM CLOSET)	N/A
X	STANDARD TELECOMMUNICATION OUTLET	2-GANG BOX WITH TRIM RING	N/A	48" AFF	N/A	"X" CATEGORY CABLES (TO TELECOM CLOSET)	N/A
W	WALL PHONE TELECOMMUNICATIONS OUTLET	2-GANG BOX WITH TRIM RING	N/A	SWITCH HEIGHT	N/A	ONE (1) CATEGORY CABLE	N/A
# AV	MULTI-MEDIA FLOORBOX	WIREMOLD EFB45S	THREE (3) 1-1/4" EC	IN FLOOR	N/A	(#) CATEGORY CABLES	DUPLEX RECEPTACLE
#	FLOORBOX	WIREMOLD EFB45S	THREE (3) 1-1/4" EC	IN FLOOR	N/A	(#) CATEGORY CABLES	120V DUPLEX RECEPTACLE
W P/C/U	WIRELESS ACCESS POINT P/C/U - REF SHEET NOTES	SURFACE MOUNTED BISCUIT BOX, U.N.O.	N/A, U.N.O.	CEILING MOUNTED	WIRELESS ACCESS POINT	TWO (2) CATEGORY CABLE	REMOTE LOW VOLTAGE POWER
W P/C/U	WIRELESS ACCESS POINT P/C/U - REF SHEET NOTES	2-GANG BOX	ONE (1) 1-1/4" EC	96" AFF	WIRELESS ACCESS POINT	TWO (2) CATEGORY CABLE	REMOTE LOW VOLTAGE POWER
D	ELECTRONIC ACCESS CONTROL DOOR	REFER TO ACCESS CONTROL DOOR DETAILS	REFER TO ACCESS CONTROL DOOR DETAILS	REFER TO ACCESS CONTROL DOOR DETAILS	REFER TO ACCESS CONTROL DOOR DETAILS	N/A	REMOTE LOW VOLTAGE POWER
CR	CARD READER	2-GANG BOX WITH SINGLE GANG TRIM RING	ONE (1) 1" EC	REFER TO ACCESS CONTROL DOOR DETAILS	CARD READER	N/A	REMOTE LOW VOLTAGE POWER
C	FIXED SURVEILLANCE VIDEO CAMERA	SURFACE MOUNTED BISCUIT BOX	N/A	CEILING MOUNTED	FIXED VIDEO CAMERA	ONE (1) CATEGORY CABLE	REMOTE LOW VOLTAGE POWER
E C	EXTERIOR SURVEILLANCE VIDEO CAMERA	2-GANG BOX INTERIOR TO BUILDING	ONE (1) 1" EC	VARIES	EXTERIOR VIDEO CAMERA	ONE (1) CATEGORY CABLE	REMOTE LOW VOLTAGE POWER

LOW VOLTAGE SYSTEM SHEET LIST

Sheet Number	Sheet Name
TA001	LOW VOLTAGE SYSTEMS TITLESHEET
TA002	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS
TA003	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS
TA004	LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS
TA010	TELECOM RISER DIAGRAM
TA101	PLANS - HOME CLUBHOUSE
TA102	PLANS - VISITOR CLUBHOUSE
TA103	PLANS - BATTING TUNNELS
TA104	PLANS - BULLPENS, DUGOUTS, SECURITY FEED ROOM
TA700	AUDIOVISUAL SIGNAL FLOWS

TA SERIES SHEET NOTES

1. ALL CONDUIT, BACK BOXES, AND AC POWER REQUIREMENTS SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
2. ANY CONDUIT TERMINATIONS AT CONSOLE OR EQUIPMENT RACK LOCATIONS SHOULD BE ACCESSIBLE.
3. EACH LOW VOLTAGE OUTLET SHALL INCLUDE A 200lb TEST PULL WIRE TO ACCESSIBLE AFC OR CABLE TRAY UNLESS OTHERWISE NOTED.
4. AC POWER CIRCUITS OUTLINED FOR USE WITH THE LOW VOLTAGE ELEMENTS SHALL BE TIED TO A SINGLE PHASE OF THE ELECTRICAL POWER SUPPLY.
5. REFERENCE ELECTRICAL DIVISION 26 00 00 SPECIFICATION FOR CONDUIT SPECIFICATIONS.
6. COORDINATE CEILING MOUNTED ELEMENTS WITH ARCHITECTURAL CEILING PLANS.
7. REFERENCE ARCHITECTURAL DRAWINGS FOR ALL BOX LOCATIONS AND DIMENSIONS.
8. ALL TELECOM CONDUITS ARE TO RUN FROM BACK BOX TO ACCESSIBLE AFC UNLESS DETAILED OTHERWISE.
9. NOTES ON INDIVIDUAL DRAWING SHEETS SUPERSEDE THE ABOVE REQUIREMENTS.
10. WIRELESS ACCESS POINT LABELS: P - PLAYERS, S - STAFF, U - UMPIRES.

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DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE As indicated

DRAWING NAME

LOW VOLTAGE SYSTEMS TITLESHEET

PHASE
CD

DRAWING NO.
TA001

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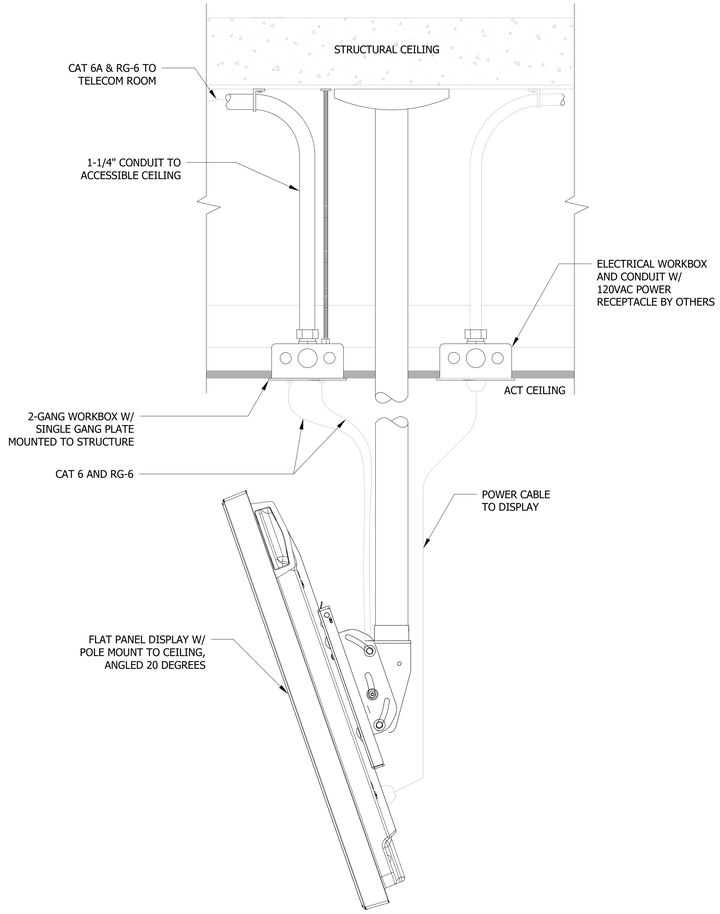
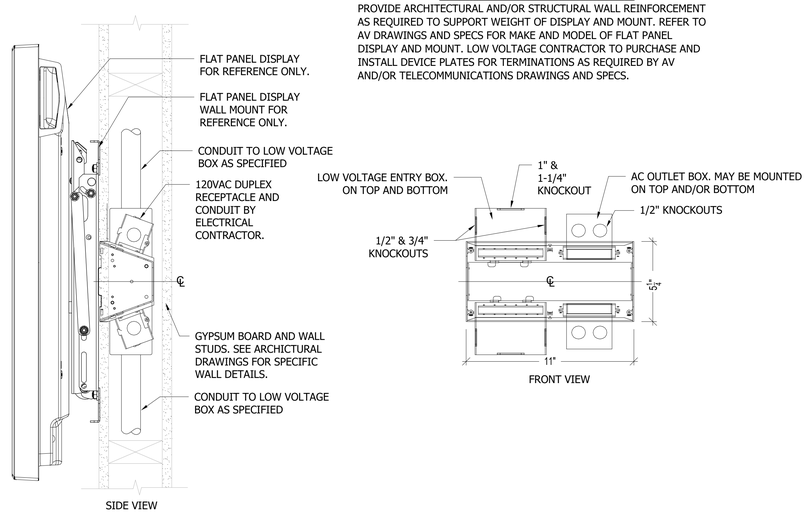


4 CEILING POLE MOUNTED DISPLAY

3" = 1'-0"



SIDE VIEW

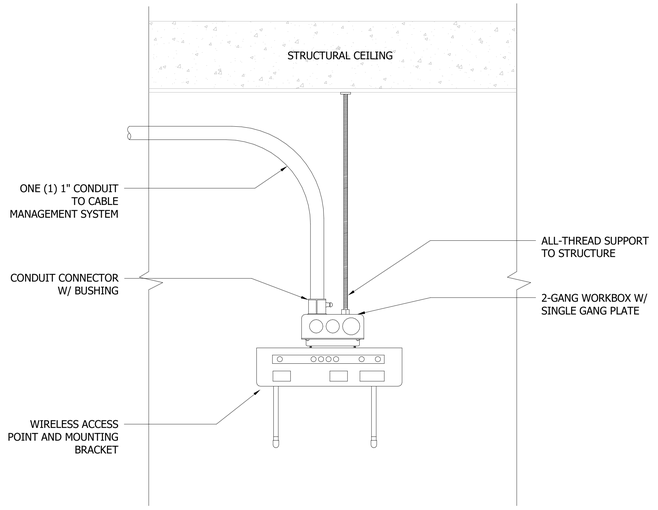
PWB-100 FLAT PANEL DISPLAY WALLBOX

PROVIDE ARCHITECTURAL AND/OR STRUCTURAL WALL REINFORCEMENT AS REQUIRED TO SUPPORT WEIGHT OF DISPLAY AND MOUNT. REFER TO AV DRAWINGS AND SPECS FOR MAKE AND MODEL OF FLAT PANEL DISPLAY AND MOUNT. LOW VOLTAGE CONTRACTOR TO PURCHASE AND INSTALL DEVICE PLATES FOR TERMINATIONS AS REQUIRED BY AV AND/OR TELECOMMUNICATIONS DRAWINGS AND SPECS.

FRONT VIEW

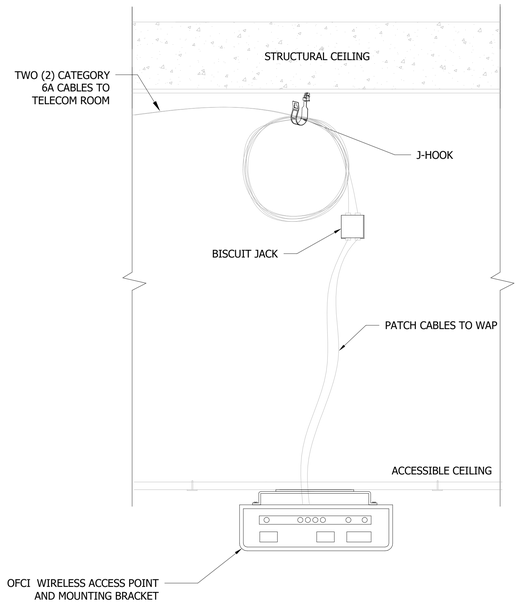
3 WALL MOUNTED DISPLAY

3" = 1'-0"



2 STRUCTURAL CEILING MOUNTED WAP

3" = 1'-0"



1 ACT CEILING MOUNTED WAP

3" = 1'-0"

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PROJECT NO. 20230573 SCALE

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LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS

PHASE
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TA002

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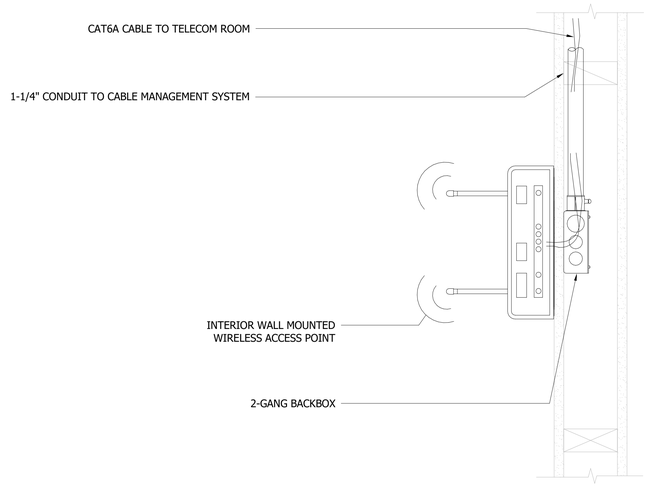
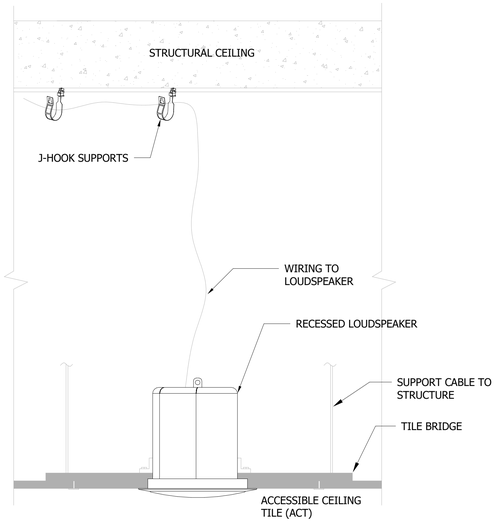
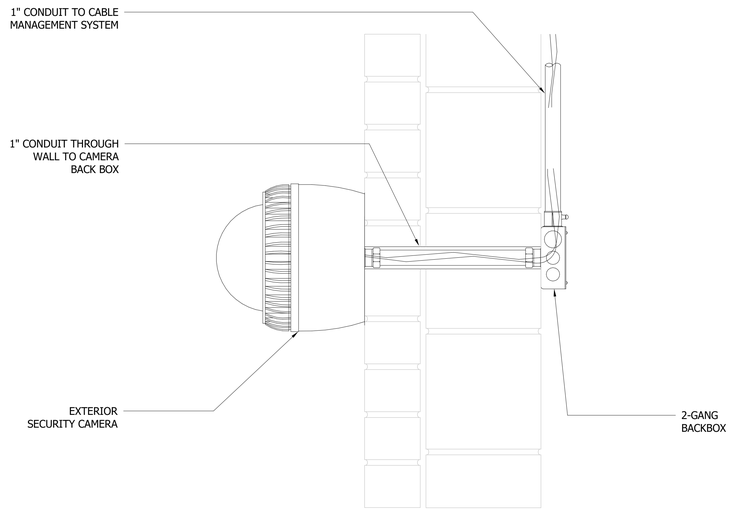


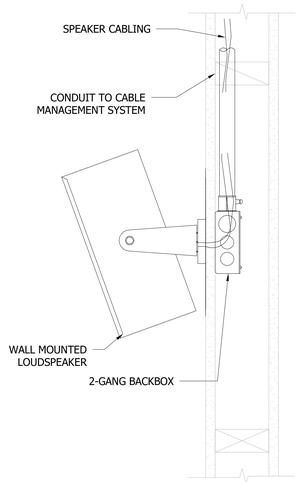
4 **WALL MOUNTED WAP**
3" = 1'-0"



2 **CEILING RECESSED LOUDSPEAKER**
3" = 1'-0"



3 **EXTERIOR SURVEILLANCE CAMERA**
3" = 1'-0"



1 **WALL MOUNTED LOUDSPEAKER**
3" = 1'-0"

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LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS
PHASE CD
DRAWING NO. TA003

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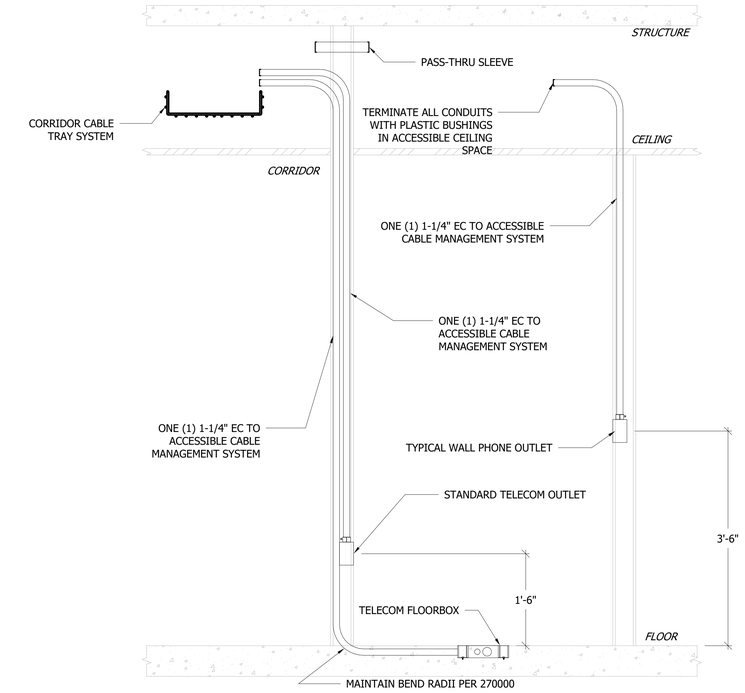
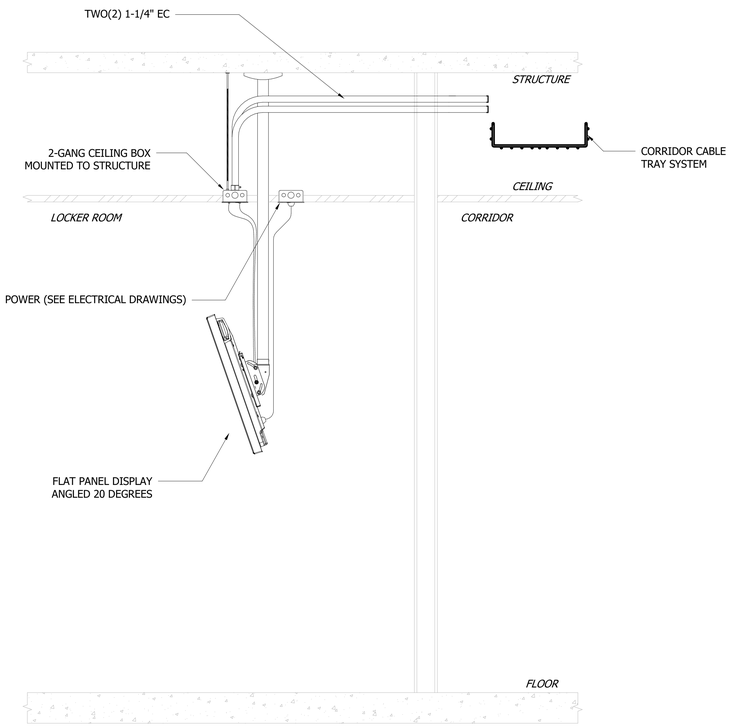


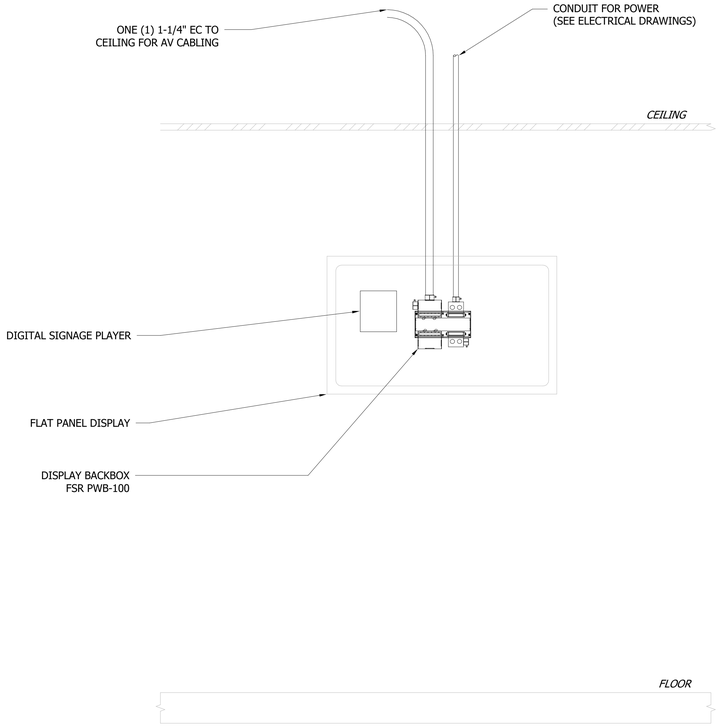
1 TYPICAL TELECOM DETAILS

1" = 1'-0"



2 LOCKER ROOM CEILING DISPLAY

1" = 1'-0"



3 TYPICAL DIGITAL SIGNAGE

1" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

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Baltimore, MD 21230-3870
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Gilbane

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KEY PLAN

PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	EC	ISSUE 4: 70% CONSTRUCTION DOCUMENTS	6/21/24

ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

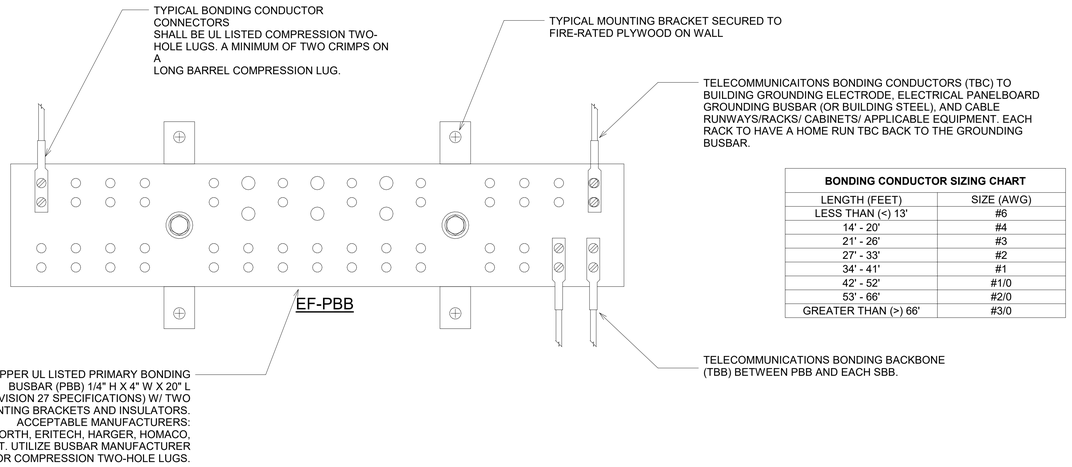
PROJECT NO. 20230573 SCALE 1" = 1'-0"

DRAWING NAME
LOW VOLTAGE SYSTEMS INFRASTRUCTURE DETAILS

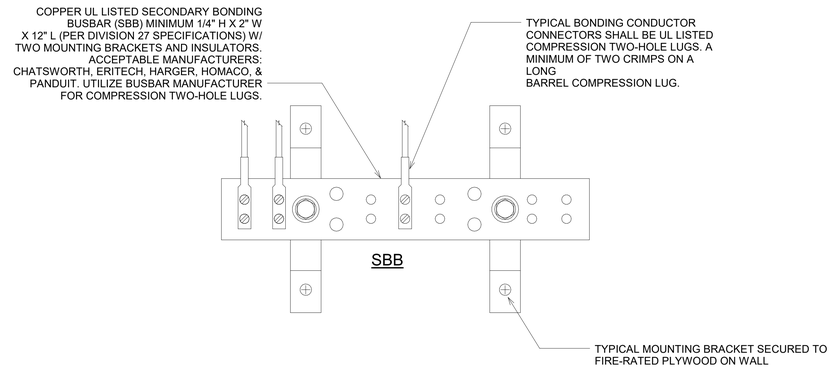
PHASE
CD

DRAWING NO.
TA004

6/21/2024 6:25:06 AM C:\Users\chrisdoyhergow\Documents\TA-Perdue Stadium - 2024_cgowLSVFU.rvt



BONDING CONDUCTOR SIZING CHART	
LENGTH (FEET)	SIZE (AWG)
LESS THAN (<) 13'	#6
14' - 20'	#4
21' - 26'	#3
27' - 33'	#2
34' - 41'	#1
42' - 52'	#1/0
53' - 66'	#2/0
GREATER THAN (>) 66'	#3/0



SHEET NOTES:

1. PROVIDE 12SM/12MM FIBER, ONE (1) 0.500" COAX MDF TO EACH IDF.

2 TELECOMMUNICATIONS GROUNDING DETAILS

6" = 1'-0"

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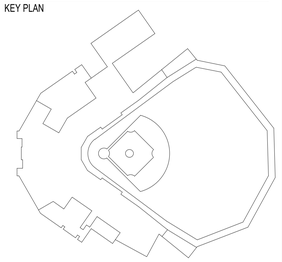

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ARTHUR PERDUE STADIUM IMPROVEMENTS

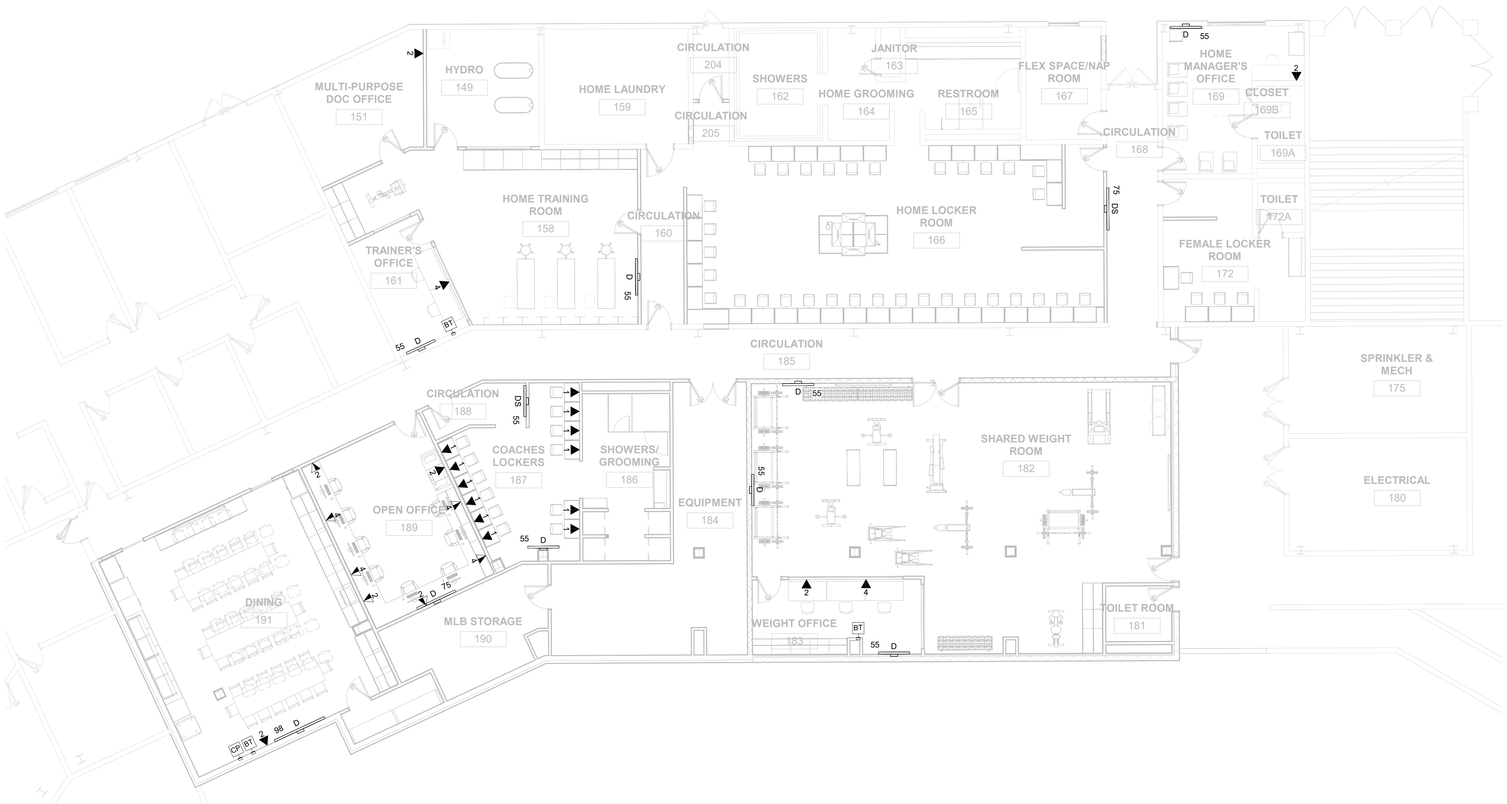
6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE
PROJECT NO. 20230573 SCALE 6" = 1'-0"
DRAWING NAME

TELECOM RISER DIAGRAM

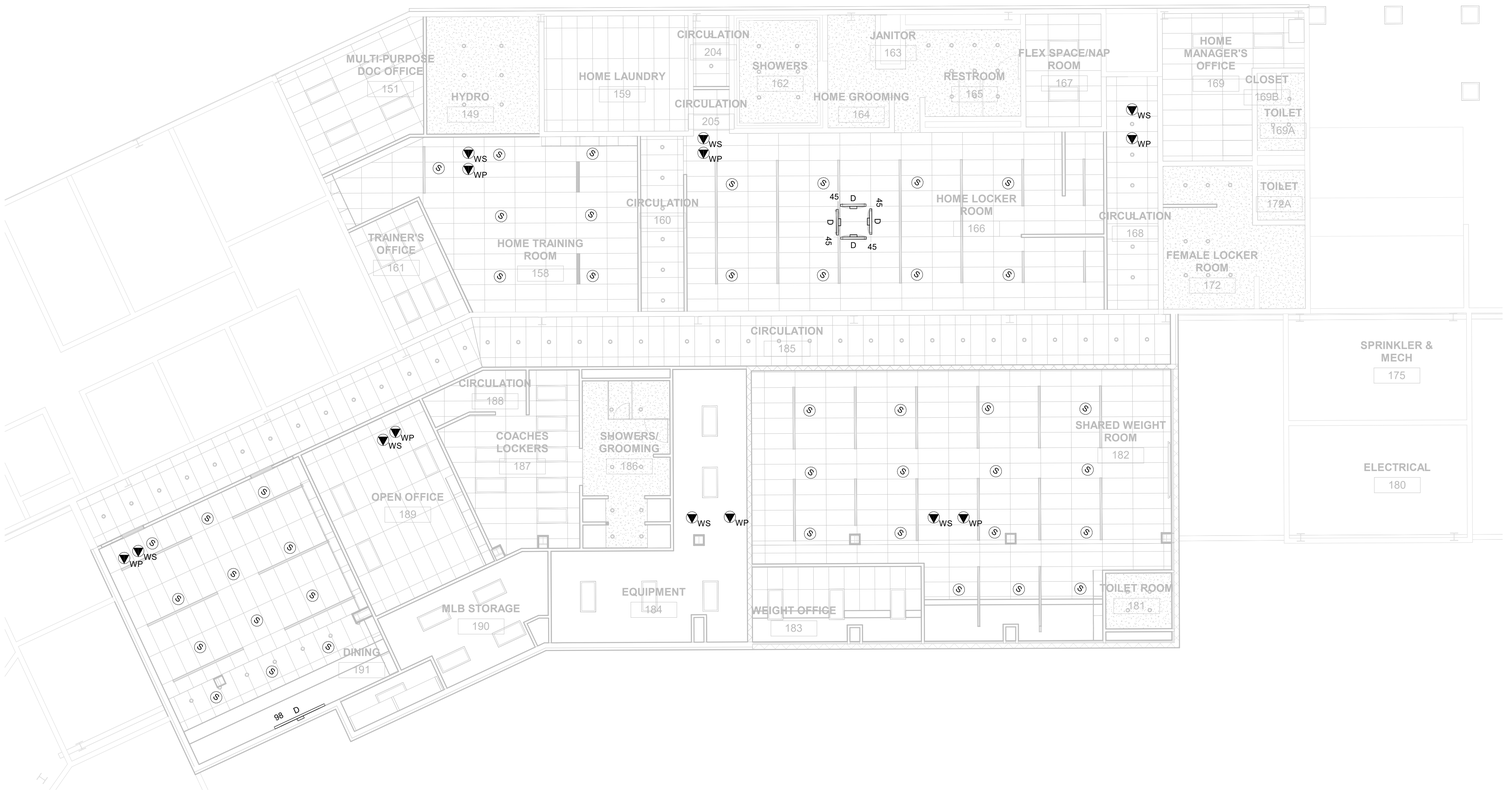
PHASE CD
DRAWING NO. TA010

6/21/2024 6:25:06 AM C:\Users\christophergow\Documents\TA-Perdue Stadium - 2024_cgowLSVFU.rvt



1 **FLOOR PLAN - HOME CLUBHOUSE**

1/8" = 1'-0"



2 **RCP - HOME CLUBHOUSE**

1/8" = 1'-0"

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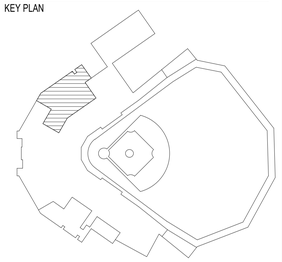
KEY PLAN



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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

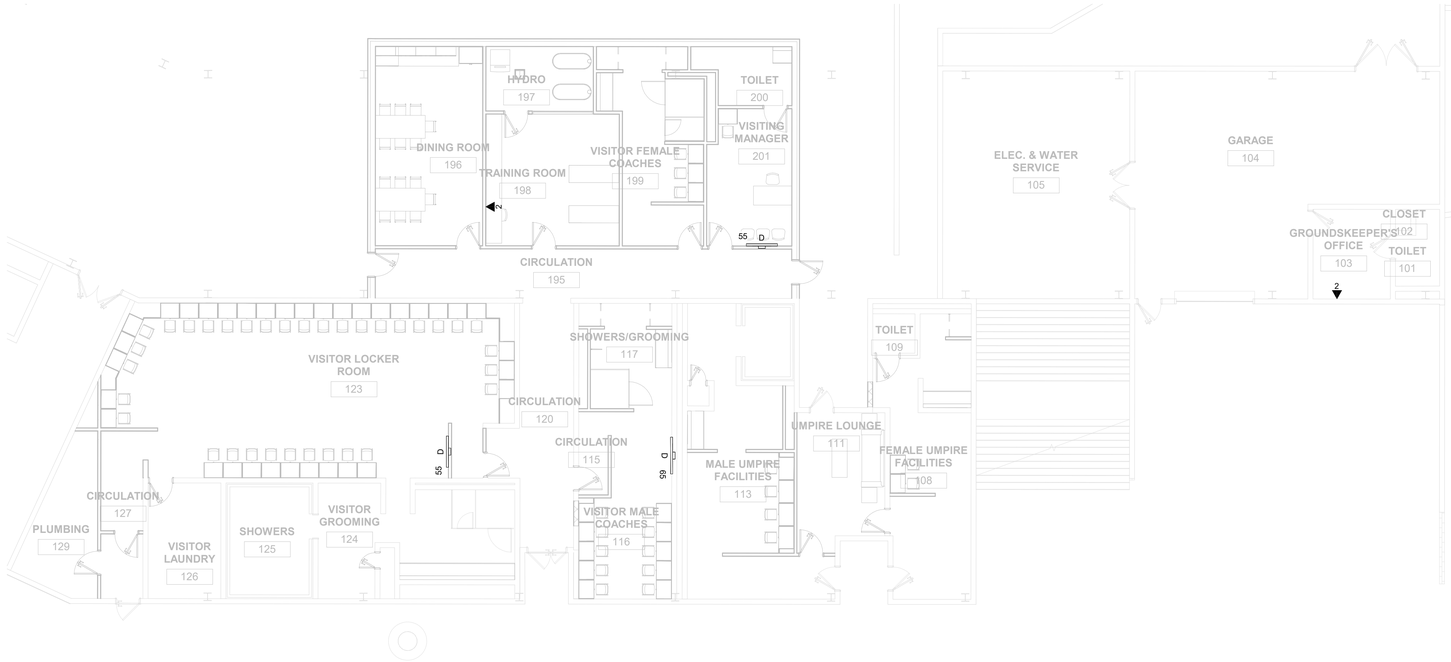
DRAWING NAME

PLANS - HOME CLUBHOUSE

PHASE CD

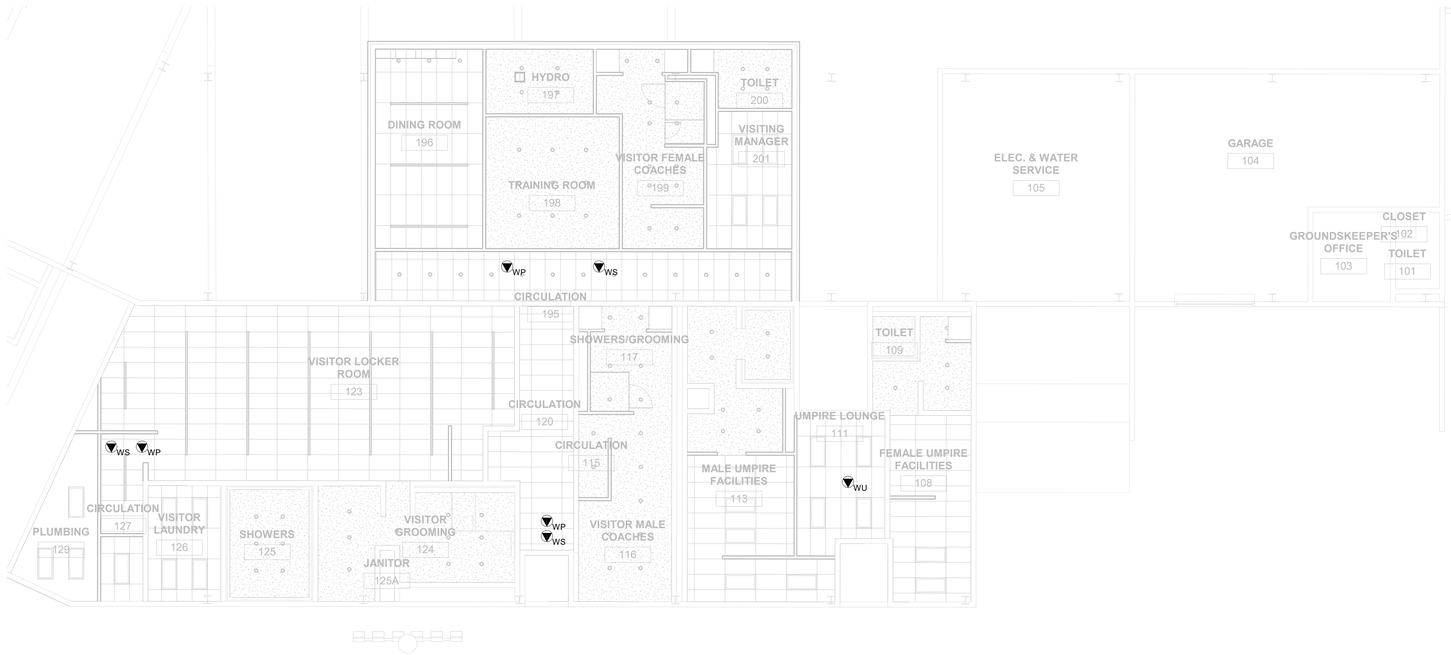
DRAWING NO. TA101

6/21/2024 6:25:14 AM C:\Users\christophergrow\Documents\TA-Perdue Stadium - 2024_cgrow.SVFU.rvt



1 FLOOR PLAN - VISITOR CLUBHOUSE

1/8" = 1'-0"



2 RCP - VISITOR CLUBHOUSE

1/8" = 1'-0"

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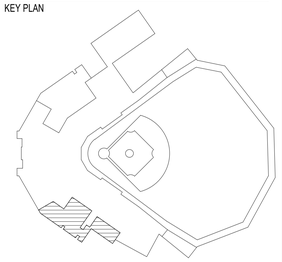

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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

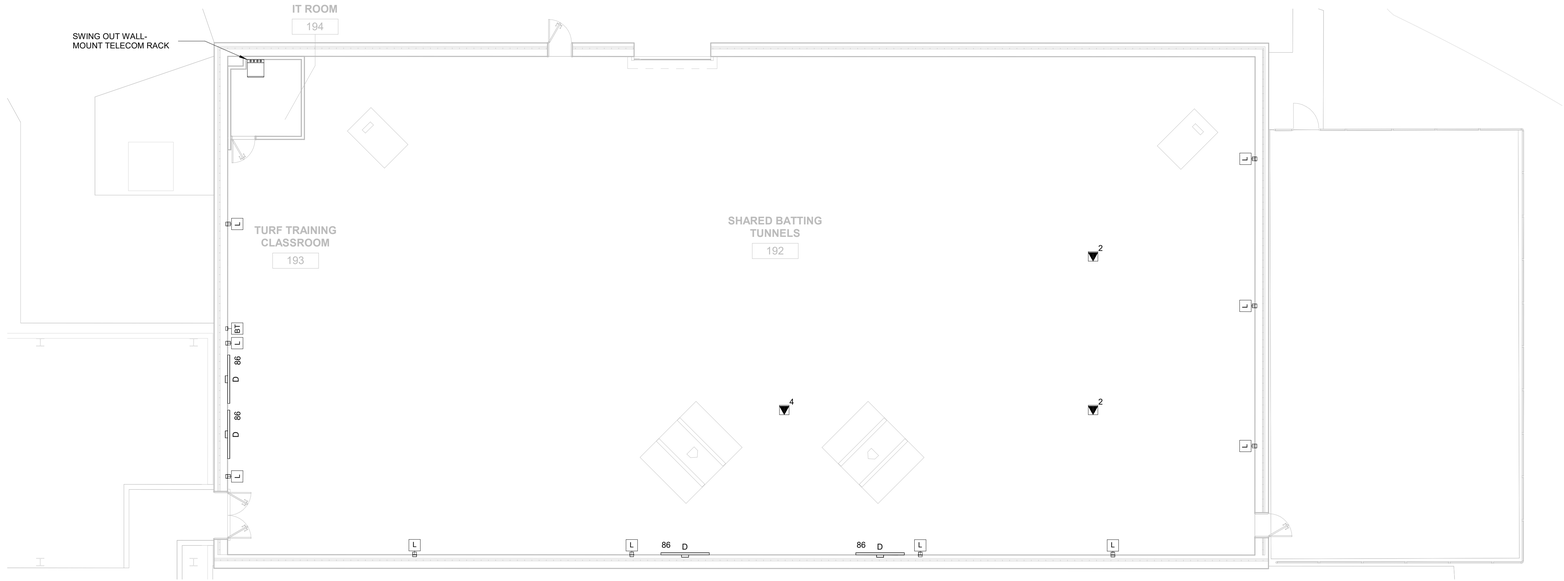
DRAWING NAME

PLANS - VISITOR CLUBHOUSE

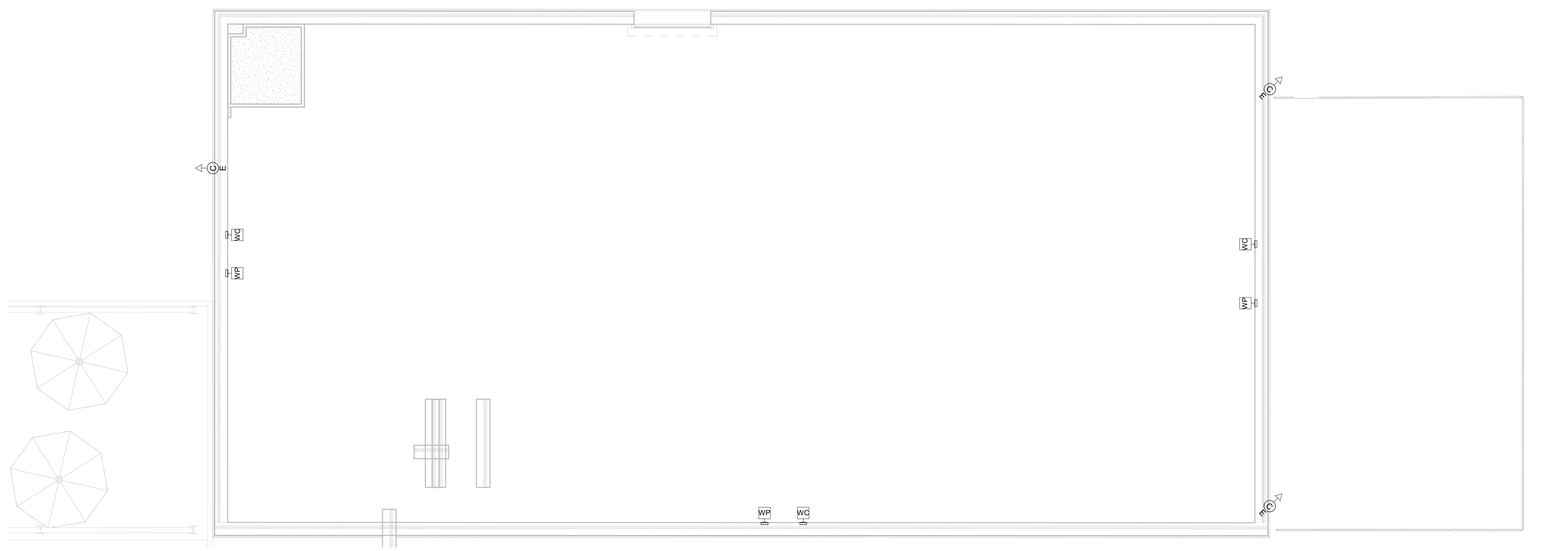
PHASE CD

DRAWING NO. TA102

6/21/2024 6:25:18 AM C:\Users\christopherpow\Documents\TA-Perdue Stadium - 2024_cpowLSVFU.rvt



1 **FLOOR PLAN - BATTING TUNNELS**
1/8" = 1'-0"



2 **RCP - BATTING TUNNELS**
1/8" = 1'-0"

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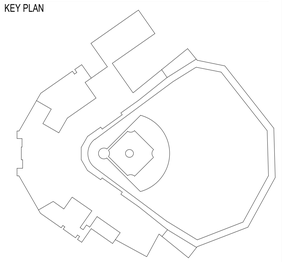
KEY PLAN



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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/8" = 1'-0"

DRAWING NAME

PLANS - BATTING TUNNELS

PHASE CD

DRAWING NO. TA103

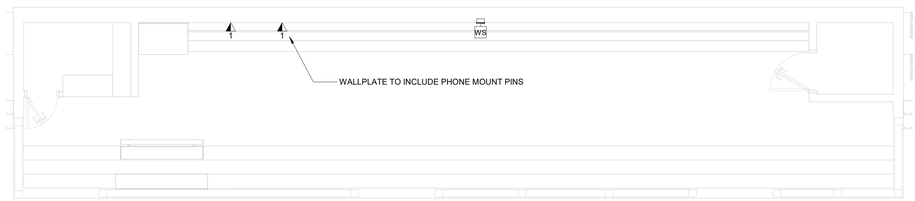
6/21/2024 6:25:19 AM C:\Users\christophergow\Documents\TA-Perdue Stadium - 2024_cgowLS-VFU.rvt

1 HOME BULLPEN SHEETS

1/4" = 1'-0"

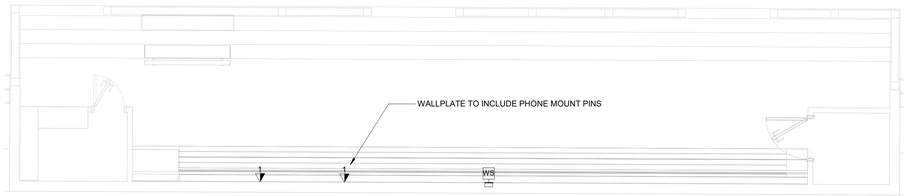
2 VISITOR BULLPEN SHEETS

1/4" = 1'-0"



3 HOME DUGOUT Sheets

1/4" = 1'-0"



4 VISITOR DUGOUT SHEETS

1/4" = 1'-0"

5 VIDEO SURVEILLANCE ROOM

1/4" = 1'-0"

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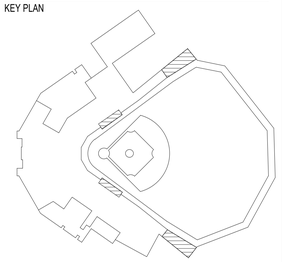
KEY PLAN



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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 1/4" = 1'-0"

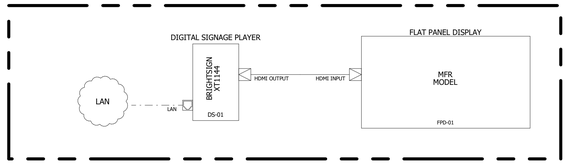
DRAWING NAME
PLANS - BULLPENS, DUGOUTS, SECURITY FEED ROOM

PHASE
CD

DRAWING NO.
TA104

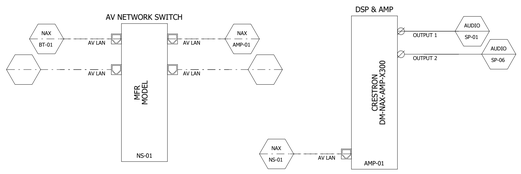
6/21/2024 6:26:22 AM C:\Users\christopher.gow\Documents\TA-Perdue Stadium - 2024_cgow.SVFU.rvt

SIGNAL FLOW TYPICAL OF DIGITAL SIGNAGE AND HOME LOCKER ROOM CEILING DISPLAYS

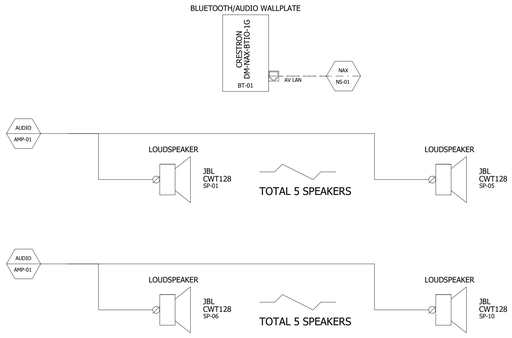


COMPONENTS LOCATED IN THE BATTING TUNNELS

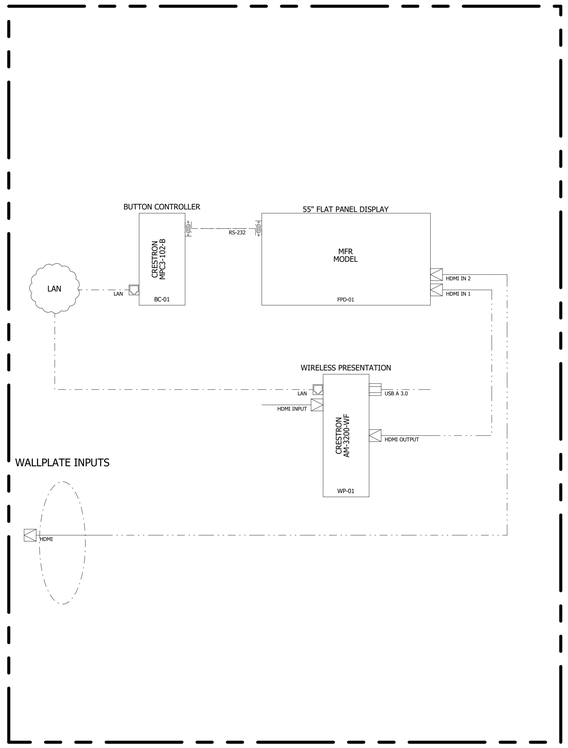
RACK MOUNTED ELEMENTS



WALL MOUNTED ELEMENTS



SIGNAL FLOW TYPICAL OF ROOMS 158, 161, 169, 183, 187, 189



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ARTHUR PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALSBURY, MD, 21804

DRAWN BY EC DATE

PROJECT NO. 20230573 SCALE 12" = 1'-0"

DRAWING NAME

AUDIOVISUAL SIGNAL FLOWS

PHASE
CD

DRAWING NO.
TA700

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ABBREVIATIONS

A	AMPERE	M.H.	MOUNTING HEIGHT
A.C	ABOVE COUNTER	NAC	NOTIFICATION APPLIANCE CIRCUIT
A.F.F.	ABOVE FINISHED FLOOR	N.E.C.	NATIONAL ELECTRIC CODE
A.F.G.	ABOVE FINISHED GRADE	P / PH	PHASE
BAS	BUILDING AUTOMATION SYSTEM	RM	REMOTE MICROPHONE CONSOLE
CKT	CIRCUIT	SLC	SIGNALING LINE CIRCUIT
CD	CANDELA	TYP	TYPICAL
FAC	FIRE ALARM COMMUNICATOR	U.O.N.	UNLESS OTHERWISE NOTED
FACP	FIRE ALARM CONTROL PANEL	V	VOLTAGE
FATC	FIRE ALARM TERMINAL CABINET	W/	WITH
GAP	GRAPHIC ANNUNCIATOR PANEL	W	WIRE
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	WP	WEATHERPROOF
IDC	INITIATING DEVICE CIRCUIT		

FIRE ALARM GENERAL NOTES

1. ANY CONFLICT AND/OR DISCREPANCY BETWEEN THESE GENERAL NOTES AND ANY OTHER INFORMATION CONTAINED IN THE CONTRACT DOCUMENTS, THE MORE STRINGENT REQUIREMENT SHALL PREVAIL AND BE A REQUIREMENT OF THE WORK. THAT NOTWITHSTANDING, ANY SUCH CONFLICT AND/OR DISCREPANCY SHALL PROMPTLY BE BROUGHT TO THE ATTENTION OF THE OWNER, ARCHITECT AND ENGINEER.
2. THE WORK INCLUDES, BUT IS NOT LIMITED TO EXTENDING EXISTING TO REMAIN COMPLETELY SUPERVISED, INTELLIGENT, ANALOG, ADDRESSABLE FIRE ALARM AND DETECTION SYSTEM AS INDICATED IN THE CONTRACT DOCUMENTS. THE WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, ALL WIRING, RACEWAYS, PULL BOXES, TERMINAL CABINETS, OUTLET AND MOUNTING BOXES, CONTROL EQUIPMENT, ALARM AND SUPERVISORY SIGNALS, INITIATING DEVICES, ALARM NOTIFICATION APPLIANCES, NOTIFICATION ALARM PANELS, INTERFACE EQUIPMENT, AND ALL OTHER ACCESSORIES AND MISCELLANEOUS ITEMS INCLUDING SOFTWARE, SYSTEM PROGRAMMING, TEST AND CONSTRUCTION PERMITS REQUIRED FOR A COMPLETE OPERATING SYSTEM NORMALLY AND CUSTOMARILY REQUIRED, WHETHER INDICATED OR INHERENTLY NECESSARY DUE TO THE NATURE OF THE WORK.
3. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE TO SHOW DEVICE COUNTS AND GENERAL LOCATIONS ONLY. CONTRACTOR IS RESPONSIBLE FOR DESIGN DRAWINGS AND INSTALLATION OF DEVICES IN ACCORDANCE WITH LOCAL CODES, PROJECT SPECIFICATIONS, AND MANUFACTURER'S REQUIREMENTS.
4. PROVIDE ALL NECESSARY PERMITS, INSPECTIONS AND FINAL SYSTEM ACCEPTANCE FROM THE AUTHORITY HAVING JURISDICTION (AHJ).
5. FIRE ALARM CONTRACTOR SHALL PREPARE SHOP DRAWINGS, CALCULATIONS, AND EQUIPMENT CUT SHEETS, AND SUBMIT THEM TO AUTHORITY HAVING JURISDICTION (AHJ) FOR APPROVAL. APPROVAL MUST BE RECEIVED BEFORE START OF WORK.
6. THE SYSTEM SHALL PROVIDE GENERAL EVACUATION SIGNALING THROUGHOUT THE BUILDING. UPON ACTIVATION OF AN ALARM SIGNAL, THE SYSTEM SHALL INITIATE A PRE-RECORDED EMERGENCY VOICE SIGNAL AND VISIBLE STROBE SIGNALING IN ALL REQUIRED AREAS PER PUBLIC MODE CRITERIA IN ACCORDANCE WITH NFPA 72.
7. COORDINATE ALL WORK AND AVOID ALL CONFLICTS WITH LIGHTING FIXTURES, DIFFUSERS, GRILLS, DUCTS, STRUCTURAL MEMBERS, PIPES AND OTHER OBSTRUCTIONS.
8. SUBJECT TO ANY INFORMATION CONTAINED IN THE CONTRACT DOCUMENTS, MOUNT ALL VISUAL WARNING STROBE/AUDIBLE NOTIFICATION APPLIANCES TO ACHIEVE MAXIMUM AUDIBILITY AND VISIBILITY IN ACCORDANCE WITH NFPA 72, 2010 AND CURRENT ADAAG GUIDELINES. PROVIDE CARE IN LOCATING VISUAL WARNING STROBE APPLIANCES TO ENSURE VISIBILITY AND AVOID OBSTRUCTIONS. REFER TO ARCHITECTURAL ELEVATIONS FOR SPECIFIC MOUNTING DETAILS AND ALIGNMENTS.
9. ALL STROBES WITHIN A COMMON VIEWING AREA SHALL BE WIRED TO FLASH IN SYNCHRONIZATION. PROVIDE SYNCHRONIZATION MODULE OR OTHER EQUIPMENT WITH SYNCHRONIZATION CAPABILITIES FOR EACH STROBE CIRCUIT, WHERE REQUIRED. ALL NOTIFICATION FACEPLATE COLOR SHALL BE WHITE IN COLOR.
10. DRAWINGS DO NOT SHOW THE LOCATION OF ALL ADDRESSABLE INPUT AND CONTROL MODULES. CONTRACTOR SHALL PROVIDE NEW POINT ADDRESSABLE INPUT MODULES FOR FIRE SUPPRESSION SYSTEM SUPERVISION DEVICES AND OTHER AREAS AS REQUIRED BY THE PROJECT SPECIFICATIONS. CONTRACTOR SHALL PROVIDE NEW POINT ADDRESSABLE CONTROL MODULES AS REQUIRED FOR SYSTEM OPERATION.
11. ALL ADDRESSABLE CONTROL RELAYS SHALL BE LOCATED WITHIN 3 FEET OF CONTROLLED CIRCUIT OR DEVICE.
12. PHASE 1 ELEVATOR RECALL TO PRIMARY AND ALTERNATE FLOORS AND ELEVATOR POWER SHUNT TRIP SHALL BE PROVIDED IN ACCORDANCE WITH ALL APPLICABLE CODES.
13. ALL WIRING SHALL BE INSTALLED WITHIN CONDUIT. SUBJECT TO ANY CODE RESTRICTION AND/OR REQUIREMENT; PROVIDE ELECTRICAL METALLIC TUBING (EMT), UNLESS OTHERWISE NOTED. COORDINATE COLOR OF CONDUIT WITH ARCHITECT. LABEL CONDUIT AT 20 FT INTERVALS.
14. IN AREAS WITHOUT CEILINGS, CONDUIT SHALL BE INSTALLED AS UNOBTRUSIVELY AS POSSIBLE, AS CLOSE AS POSSIBLE TO FLOOR/CEILING SLAB AND PARALLEL AND AT RIGHT ANGLES TO STRUCTURAL STEEL OR CONCRETE.
15. CONCEAL ALL CONDUITS ABOVE SUSPENDED CEILINGS AND BEHIND WALLS. IN UNFINISHED AREAS CONDUIT MAY BE SURFACE MOUNTED, UNLESS OTHERWISE NOTED.
16. PENETRATION OF FIRE RATED ASSEMBLIES BY FIRE ALARM CONDUIT OR WIRING SHALL BE SEALED BY THE INSTALLING CONTRACTOR WITH A U.L. CLASSIFIED THROUGH PENETRATION SYSTEM CAPABLE OF MAINTAINING THE REQUIRED FIRE RESISTANCE RATING OF THE ASSEMBLY PENETRATED.
17. COORDINATE LOCATION OF AUTOMATIC SPRINKLER FLOW AND VALVE SUPERVISORY SWITCHES PRIOR TO CONDUIT ROUGH-IN TO ENSURE ACCESSIBILITY AND MINIMIZE LENGTH OF FLEXIBLE CONDUIT RUNS NECESSARY TO MAKE CONNECTIONS.
18. ELECTRICAL BOXES SHALL BE PROVIDED AS FOLLOWS: I) EXPOSED WORK - CAST METAL BELL TYPE BOXES WITH THREADED HUB, EXCEPT WHERE FACTORY BOXES ARE PROVIDED; AND II) CONCEALED WORK - BOXES MAY BE STAMPED STEEL BOXES.
19. LOCATE FIRE ALARM DEVICES INSTALLED IN ACOUSTICAL TILE CEILINGS IN THE CENTER OF THE TILE.
20. FIRE ALARM SYSTEM NOT ON A NETWORK.
21. SHOP DRAWING COMPLETE SUBMITTALS PACKAGE MUST BE COMPLETE AND EXECUTED PER NFPA 72 CHAPTER INCLUDING BUT NOT LIMITED TO ALL PLANS, CALCULATIONS, AND MATERIAL DATASHEETS. NO EXCEPTIONS; PIECE-MEAL SUBMISSIONS WILL BE AUTOMATICALLY REJECTED
22. CLOSEOUT DOCUMENTS SHALL BE PROVIDED PER NFPA 72, UPON FINAL ACCEPTANCE OF PROJECT.
23. FIRE ALARM SYSTEM INTEGRITY SHALL MEET SURVIVAIBILTY LEVEL 1 REQUIREMENTS AS PER NFPA 72.

FIRE ALARM EQUIPMENT SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING HEIGHT TO ℄ A.F.F., U.O.N.
AMP	FIRE ALARM AMPLIFIER PANEL (120VAC PRIMARY POWER)	
BPS	FIRE ALARM POWER BOOSTER PANEL (120VAC PRIMARY POWER)	
FAAP	FIRE ALARM LED GRAPHIC ANNUNCIATOR	
FACP	FIRE ALARM CONTROL PANEL (120VAC PRIMARY POWER)	
FTC	FIRE ALARM TERMINAL CABINET	
LCD	LCD ANNUNCIATOR	
RM	REMOTE MICROPHONE CONSOLE	

INTIATING DEVICE SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING HEIGHT TO ℄ A.F.F., U.O.N.
P	FIRE ALARM MANUAL PULL STATION	+42" - 48" A.F.F. (OPERATING HANDLE TO FLOOR)
H	ADDRESSABLE HEAT DETECTOR	
M	WALL-MOUNTED MAGNETIC DOOR HOLDER	
FS	SPRINKLER WATERFLOW SWITCH (FURNISHED BY THE SPRINKLER CONTRACTOR)	
TS	SPRINKLER VALVE TAMPER SWITCH (FURNISHED BY THE SPRINKLER CONTRACTOR)	
AIM	ADDRESSABLE INTERFACE MODULE	
ARM	ADDRESSABLE RELAY MODULE	
RTS	REMOTE TEST STATION	
ISO	ISOLATOR MODULE	
ACM	ADDRESSABLE CONTROL MODULE	
R	ADDRESSABLE SMOKE DETECTOR - PHOTOELECTRIC TYPE -SUBSCRIPT 'R' DENOTES ELEVATOR RECALL DEVICE	
R	WALL ADDRESSABLE SMOKE DETECTOR - PHOTOELECTRIC TYPE -SUBSCRIPT 'R' DENOTES ELEVATOR RECALL DEVICE	
	ADDRESSABLE DUCT-MOUNTED SMOKE DETECTOR	

NOTIFICATION DEVICE SYMBOLS

SYMBOL	DESCRIPTION	MOUNTING HEIGHT TO ℄ A.F.F., U.O.N.
## CM	CEILING MOUNTED COMBINATION FIRE ALARM AUDIO (SPEAKER) / VISUAL (STROBE) APPLIANCE - SUPERSCRIPT '##' DENOTES CANDELA RATING	
## WP	WALL MOUNTED COMBINATION FIRE ALARM AUDIO (SPEAKER) / VISUAL (STROBE) APPLIANCE - SUPERSCRIPT '##' DENOTES CANDELA RATING - SUBSCRIPT 'WP' DENOTES WEATHER-PROOF TYPE DEVICE	+80" - 96" A.F.F. (STROBE LENS TO FLOOR)
##	WALL MOUNTED FIRE ALARM VISUAL (STROBE) APPLIANCE - SUPERSCRIPT '##' DENOTES CANDELA RATING	+80" - 96" A.F.F. (STROBE LENS TO FLOOR)
## CM	CEILING MOUNTED FIRE ALARM VISUAL (STROBE) APPLIANCE - SUPERSCRIPT '##' DENOTES CANDELA RATING	
	WALL MOUNTED FIRE ALARM AUDIO (SPEAKER) APPLIANCE	+90" A.F.F. (TOP OF DEVICE TO FLOOR)
S	CEILING MOUNTED SPEAKER	
	BELL / CHIME	

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EC/WFT PROJ.NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

SYMBOLS, ABBREVIATIONS AND NOTES

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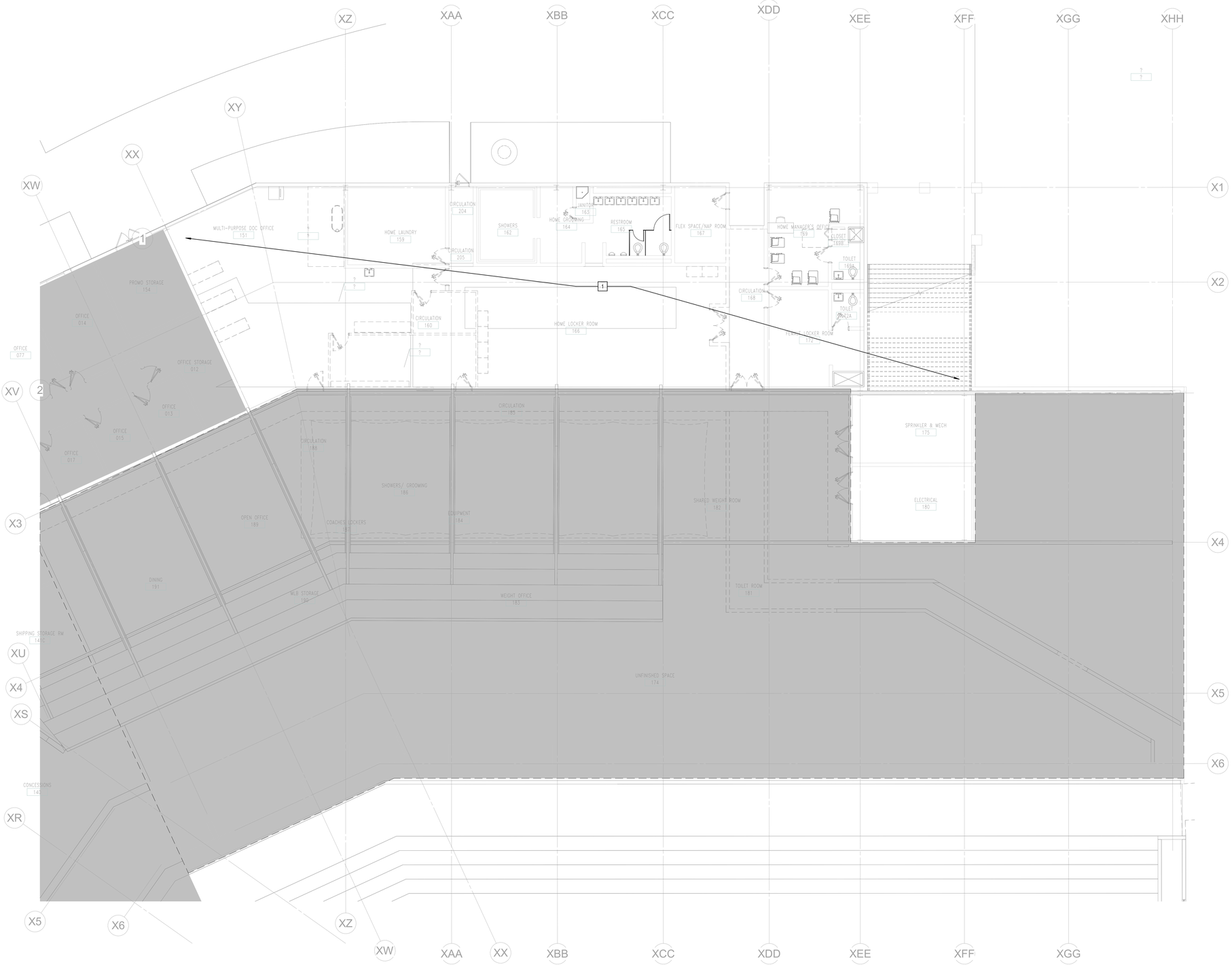

1 HOME CLUBHOUSE DEMO PLAN - FIRE ALARM

SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

DEMOLITION NOTES

1. DEMOLISH ALL EXISTING PERIPHERAL DEVICES IN AREA OF WORK. EXISTING WIRING, RACEWAY AND ASSOCIATED FITTINGS SHALL BE PRESERVED FOR RE-USE.

GENERAL DEMOLITION NOTES

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3. HATCHED AREAS ARE NOT IN SCOPE.

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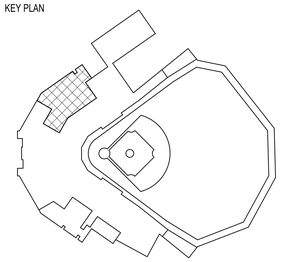

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DRAWING NAME

HOME CLUBHOUSE - DEMO PLAN - FIRE ALARM

PHASE
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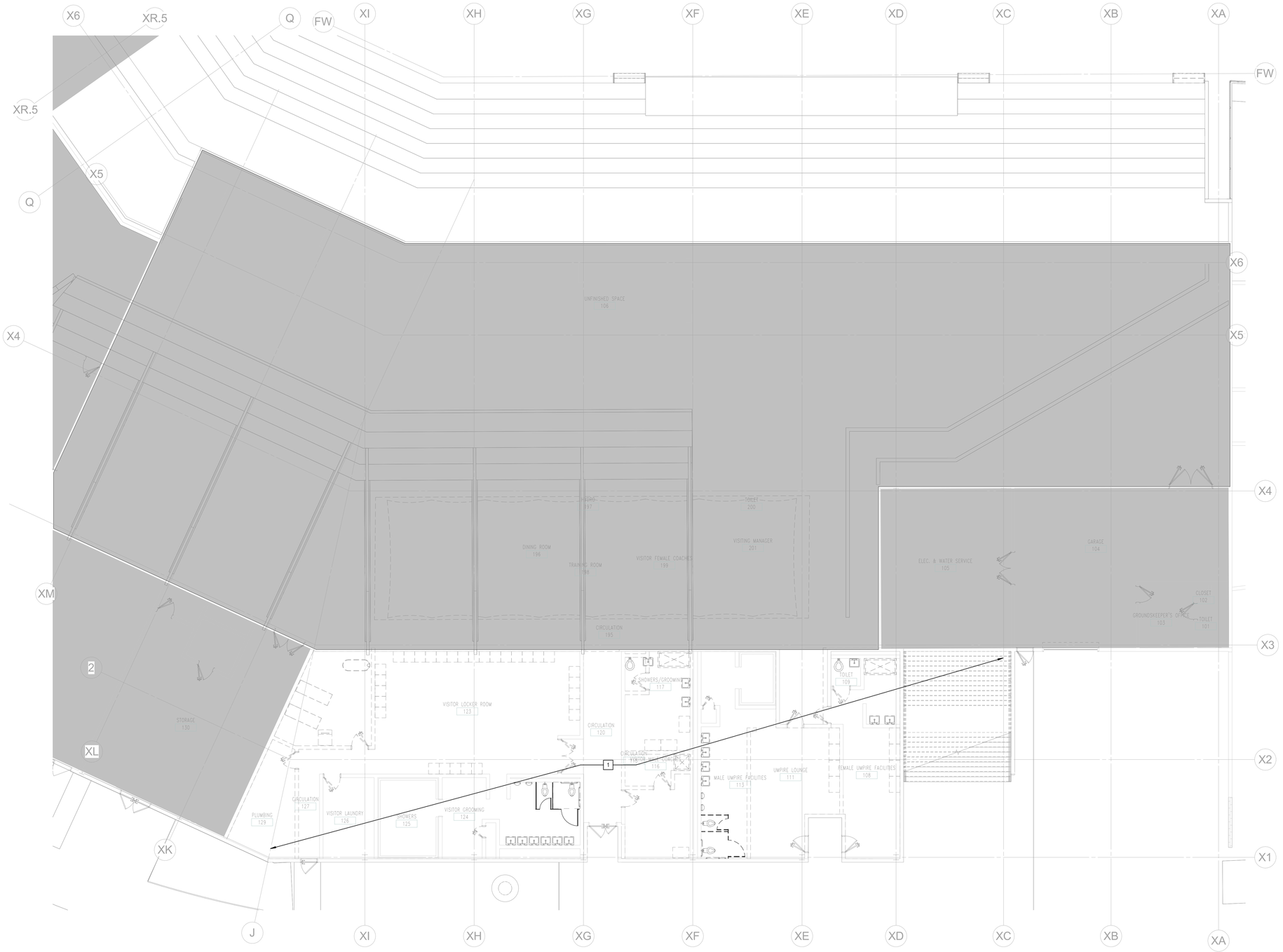

1 VISITOR CLUBHOUSE DEMO PLAN - FIRE ALARM

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8' 4' 0' 8' 16'

SCALE : 1/8" = 1'-0"

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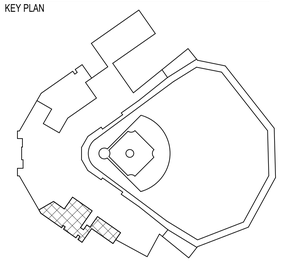

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VISITOR CLUBHOUSE - DEMO PLAN - FIRE ALARM

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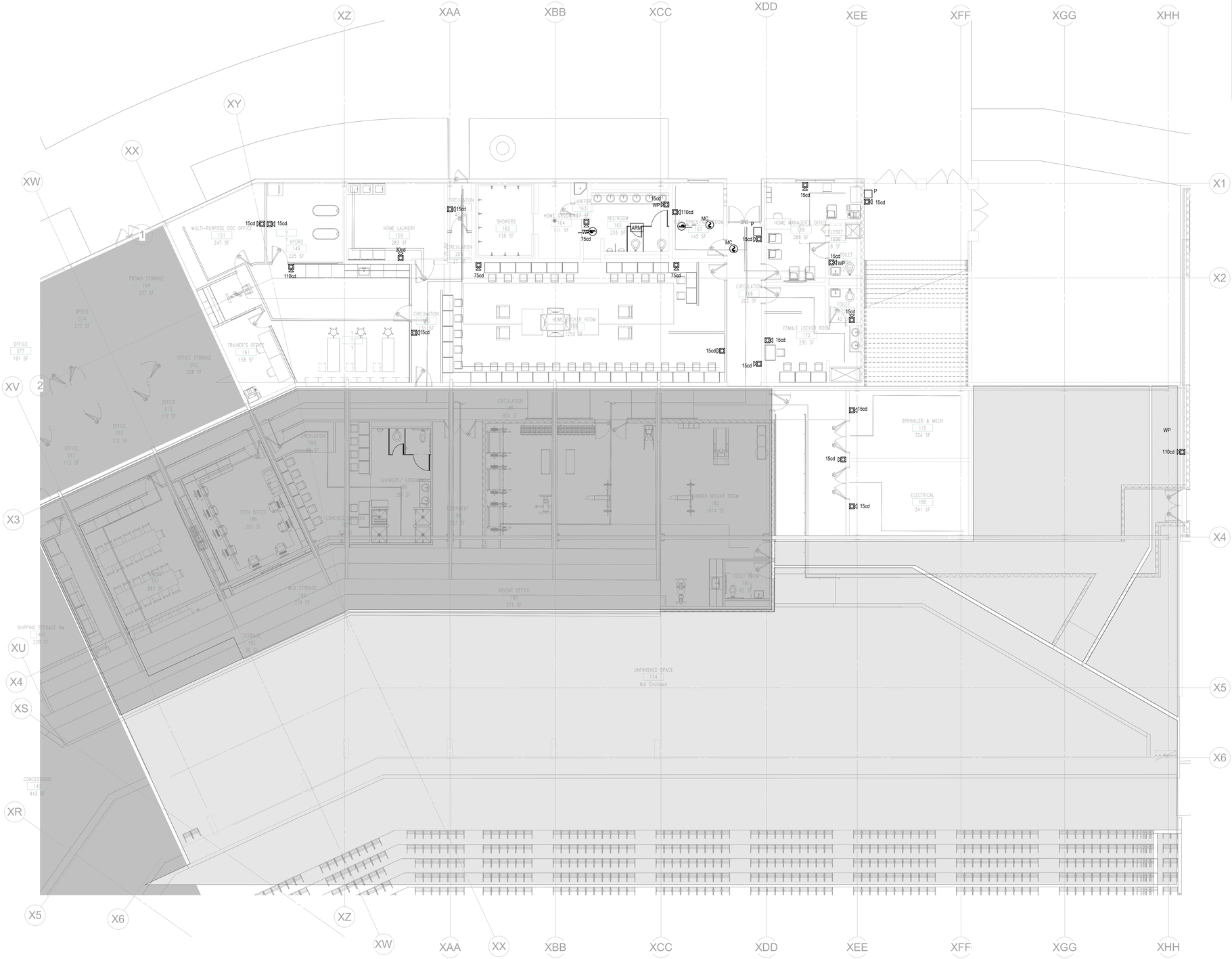

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1 HOME CLUBHOUSE NEW WORK PLAN - FIRE ALARM

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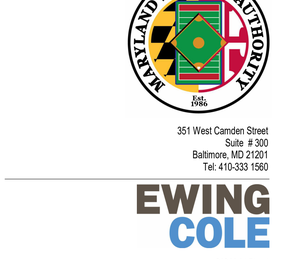

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HOME CLUBHOUSE NEW WORK PLAN - FIRE ALARM

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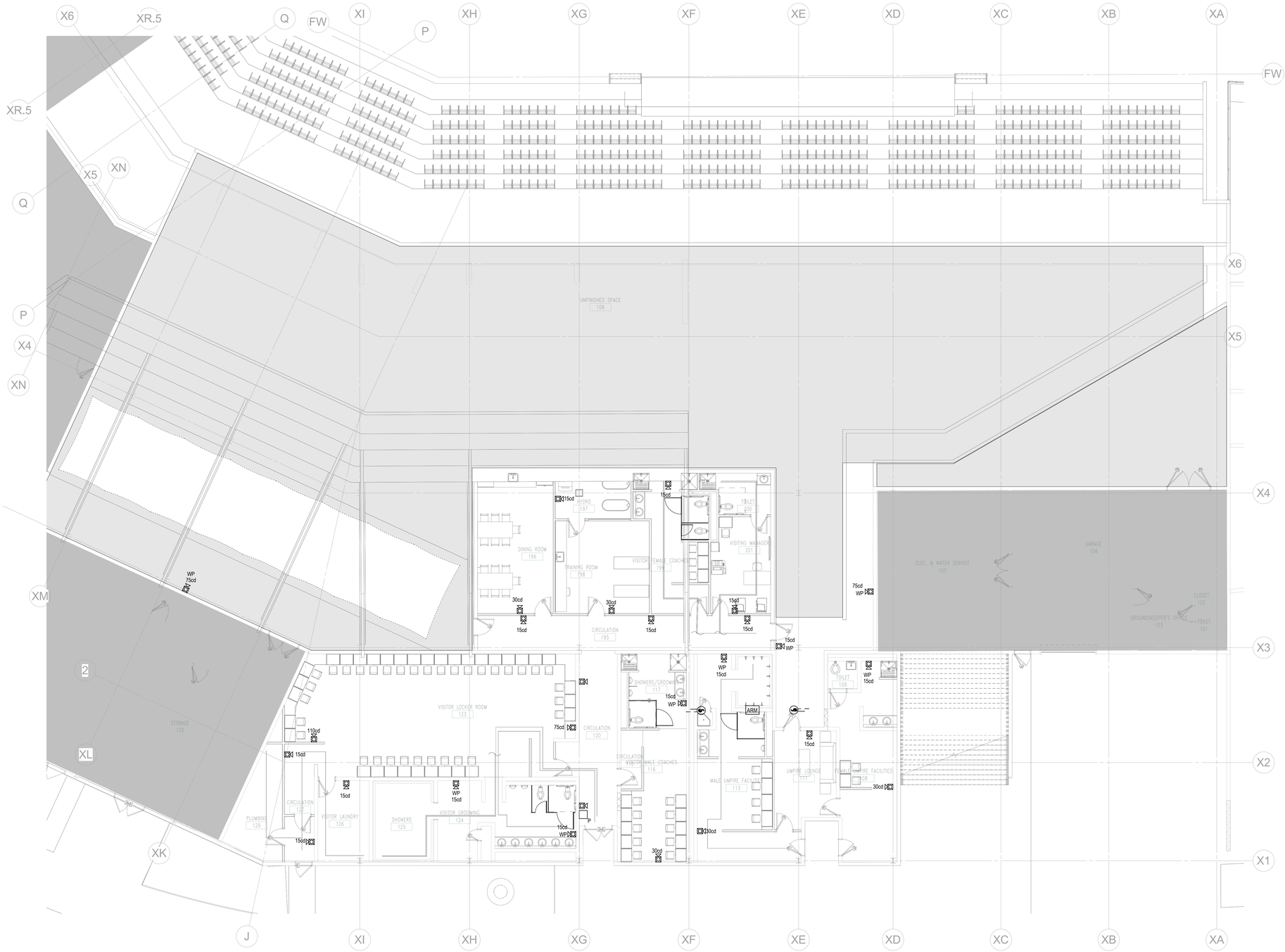

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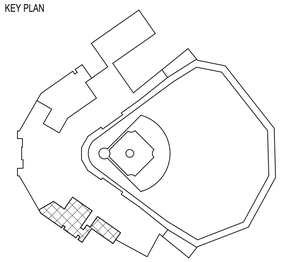

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VISITOR CLUBHOUSE NEW WORK PLAN - FIRE ALARM

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1 HOME CLUBHOUSE BATTING ARENA PLAN - FIRE ALARM
SCALE: 1/8" = 1'-0"

DRAWING NOTES

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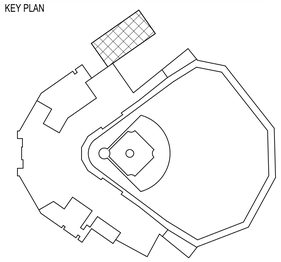

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HOME CLUBHOUSE BATTING ARENA PLAN - FIRE ALARM

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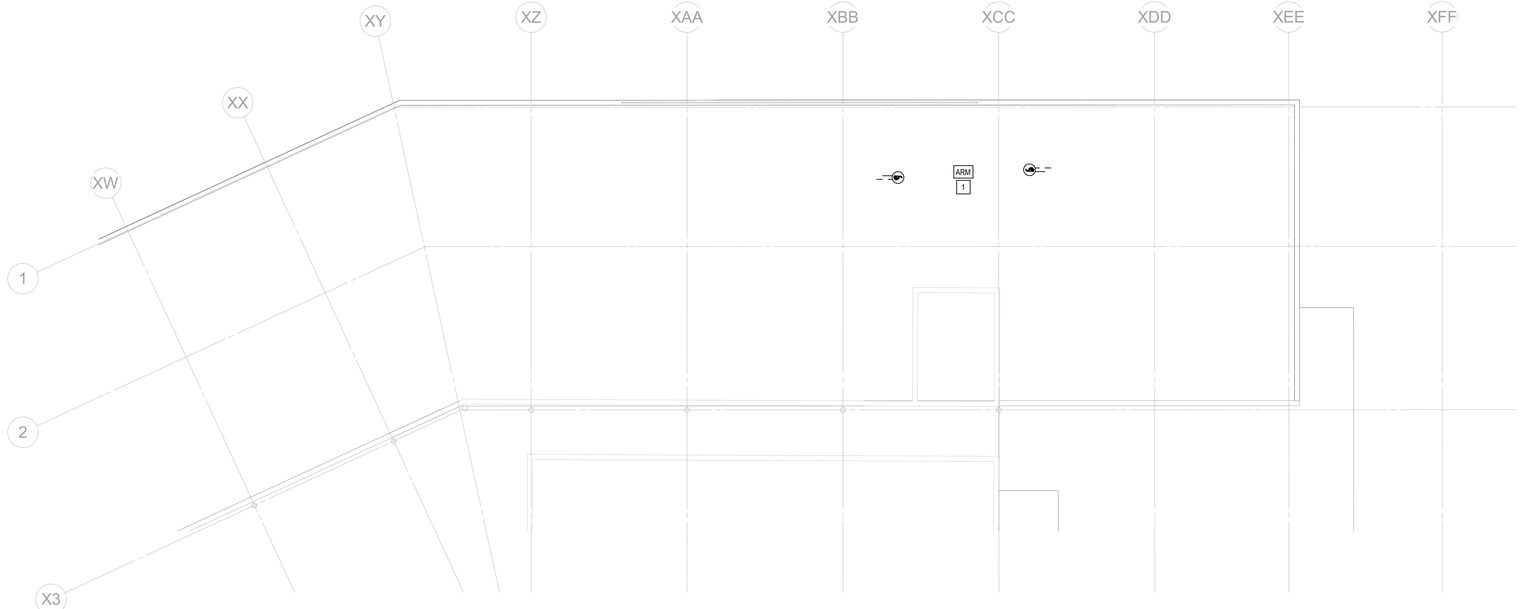
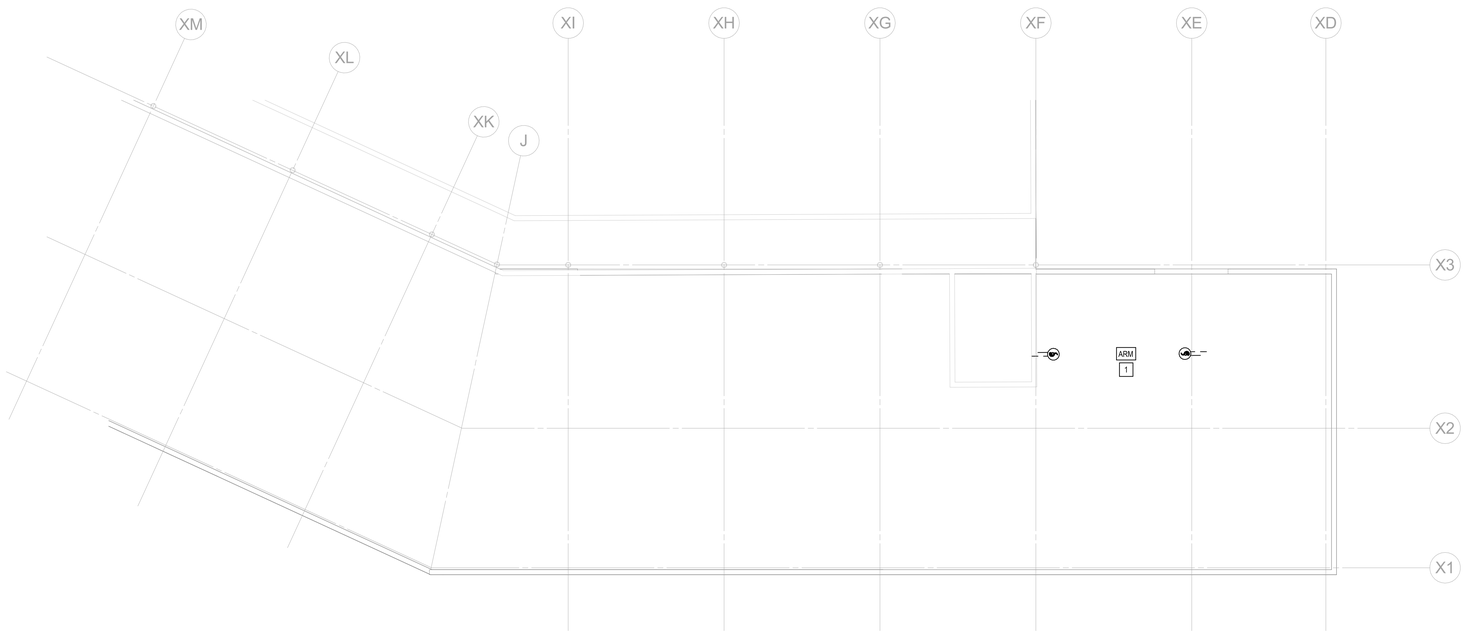


1 NEW ROOF PLAN - HOME - FIRE ALARM

SCALE: 1/8" = 1'-0"



2 NEW ROOF PLAN - VISITOR - FIRE ALARM

SCALE: 1/8" = 1'-0"

DRAWING NOTES

1 ADDRESSABLE RELAY MODULE FOR AHU SHUTDOWN.

GENERAL DEMOLITION NOTES

1. REFER TO SHEET FA0.01 FOR LEGEND, NOTES, AND ABBREVIATIONS.
2. INFORMATION ON THESE PLANS IS DIAGRAMMATIC IN NATURE FOR USE IN GENERAL LAYOUT AND COORDINATION.
3. PARTICIPATION IN THE PROJECT'S COORDINATION PROCESS IS MANDATORY. INSTALLATION SHALL NOT OCCUR PRIOR TO COORDINATION WITH ALL OTHER TRADES.
4. CONTRACTOR SHALL BE HELD ACCOUNTABLE FOR EXAMINATION AND COORDINATION WITH ALL CONTRACT DOCUMENTS INCLUDING BUT NOT LIMITED TO ARCHITECTURAL FLOOR PLANS/ REFLECTED CEILING PLANS, MECHANICAL, ELECTRICAL, PLUMBING, INFORMATION TECHNOLOGY, AND STRUCTURAL.
5. CONTRACTOR IS RESPONSIBLE FOR DELIVERY OF A TURN-KEY SYSTEM IN COMPLIANCE WITH ALL APPLICABLE CODES AND STANDARDS.
6. ALL CEILING MOUNTED FIRE ALARM DEVICE SHALL BE MOUNTED IN CENTER OF TILES.
7. ALL ADDRESSABLE DEVICES SHALL BE INSTALLED IN A CONDITIONED SPACE.
8. ALL WIRING, RACEWAY, ASSOCIATED FITTINGS AND EXISTING TO REMAIN DEVICES SHALL BE PRESERVED FOR RE-USE.
9. IF REQUIRED, CONTRACTOR SHALL TEMPORARILY INSTALL HEAT DETECTORS AT LOCATIONS WHERE SMOKE DETECTORS ARE CURRENTLY INSTALLED UNTIL CONSTRUCTION IS COMPLETE. UPON COMPLETION OF CONSTRUCTION, SMOKE DETECTORS SHALL BE RE-INSTALLED IN SAID LOCATIONS.
10. EXISTING SEQUENCE OF OPERATIONS AND WIRING INTEGRITY SHALL BE MAINTAINED.

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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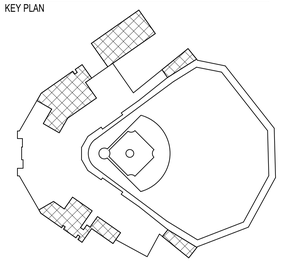

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EC/WFT PROJ NO. 20230573/23062 SCALE As indicated

DRAWING NAME

CLUBHOUSE ROOF NEW WORK PLANS - FIRE ALARM

PHASE
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DRAWING NO.
FA1.12

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FIRE PUMP TEST

SYMBOLS

1	DRAWING NOTE
F X	FIRE SUPPRESSION RISER DESIGNATION
TAG NUMER / 1 / FPXXX / DRAWING NUMBER	PARTIAL PLAN REFERENCE
	CENTERLINE
	PIPE UP
	PIPE DOWN
	PIPE CONTINUING
SP	FIRE SPRINKLER MAIN PIPING
F	FIRE SERVICE PIPING
D	SPRINKLER DRAIN PIPING
PA	PREACTION SPRINKLER PIPING
FSP	FIRE STANDPIPE PIPING
	VALVE W/ TAMPER SWITCH
F	FLOW SWITCH
T	TAMPER SWITCH
	BACKFLOW PREVENTER
	PRESSURE GAUGE
	2-1/2" FIRE HOSE VALVE W/ 1-1/2" REDUCER & CAP
	RISER LOCATION
	FIRE DEPARTMENT CONNECTION (2x2 FLUSH TYPE)
	PUMP TEST HEADER (FLUSH TYPE)
	VALVE GENERAL
	OS & Y VALVE
	PREACTION VALVE ASSEMBLY
	CHECK VALVE
W	SPRINKLER WATER CURTAIN (TYCO WS SERIES GLASS SPRINKLERS)
H	FIRE HOSE VALVE CABINET

ABBREVIATIONS

ABV	ABOVE
AFF	ABOVE FINISHED FLOOR
AHJ	AUTHORITY HAVING JURISDICTION
A.P.	ACCESS PANEL
APPROX	APPROXIMATELY
BAS	BUILDING AUTOMATIZATION SYSTEM
BOS	BOTTOM OF SHAFT
BETW	BETWEEN
BFP	BACK FLOW PREVENTER
BOT	BOTTOM
CLG	CEILING
CMU	CONCRETE MASONRY UNIT
DN	DOWN
DPV	DRY PIPE VALVE
ED	EMERGENCY DRAIN
EMR	ELEVATOR MACHINE ROOM
F	FLOW SWITCH
FHV	FIRE HOSE VALVE
GAL	GALLON
GPM	GALLONS PER MINUTE
HSW	HORIZONTAL SIDEWALL SPRINKLER
MAX	MAXIMUM
MIN	MINIMUM
NC	NORMALLY CLOSED
NO	NUMBER
NOM	NOMINAL
NPT	NATIONAL PIPE THREAD
N.T.S.	NOT TO SCALE
P	PRESSURE SWITCH
PAV	PREACTION SYSTEM VALVE
PH	PHASE
PSI	POUNDS PER SQUARE INCH
RPM	REVOLUTIONS PER MINUTE
SSP	STANDARD SPRAY PENDENT SPRINKLER
SSU	STANDARD SPRAY UPRIGHT SPRINKLER
STDP	STANDPIPE
T	TAMPER SWITCH
TOS	TOP OF SHAFT
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
UNC	UNIFIED COURSE THREAD
UNGD	UNDERGROUND
W/	WITH

FIRE PROTECTION GENERAL NOTES

1. THE PROJECT IS THE RENOVATION AND ADDITION TO AN EXISTING MINOR LEAGUE BASEBALL STADIUM. NOT ALL PORTIONS OF THE STADIUM ARE SPRINKLERED AT PRESENT. THE AREAS NOT SPRINKLERED AT PRESENT ARE THE AREAS UNDERNEATH THE GRANDSTANDS THAT ARE ENCLOSED ON THE HOME TEAM SIDE. THE DUGOUTS AND BULLPENS SHALL REMAIN UNSPRINKLERED. ALL WORK AREAS ON THE DRAWINGS THAT ARE NOT SPRINKLERED SHALL BE SPRINKLERED AS PART OF THIS PROJECT. ALL AREAS OF NEW CONSTRUCTION SHALL ALSO BE SPRINKLERED AS PART OF THIS PROJECT. THE AREA OF NEW CONSTRUCTION IS THE HOME TEAM BATTING ARENA. ALL WORK SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH THE 2015 EDITION OF THE INTERNATIONAL BUILDING CODE. 2018 EDITION OF NFPA 101, THE 2019 EDITION OF NFPA 13 AND ALL AHJ REQUIREMENTS. THE FIRE SPRINKLER SYSTEM DESIGNS FOR THE VARIOUS HAZARDS WITHIN THE BUILDING SHALL BE DETERMINED USING NFPA 13 DESIGN CRITERIA..
2. THESE PLANS ARE DIAGRAMMATIC ONLY. THEY ARE NOT INTENDED TO SHOW EVERY ITEM IN IT'S EXACT LOCATION. CONTRACTOR IS RESPONSIBLE FOR DETERMINING FINAL EQUIPMENT LOCATION AND SIZING TO PROVIDE AN APPROVED TURN-KEY SYSTEM PER THE APPLICABLE CODES AND STANDARDS.
3. SPRINKLER CONTRACTOR SHALL PREPARE SHOP DRAWINGS, HYDRAULIC CALCULATIONS AND EQUIPMENT DATA SHEETS AND SUBMIT THEM TO ARCHITECT/ENGINEER AND AHJ FOR APPROVAL. APPROVAL MUST BE RECEIVED BEFORE START OF WORK.
4. SHOP DRAWING SUBMITTALS MUST BE COMPLETE AND EXECUTED PER NFPA 13 CHAPTER 22. SUBMITTAL SHALL BE ONE COMPLETE PACKAGE INCLUDING BUT NOT LIMITED TO ALL PLANS, HYDRAULIC CALCULATIONS, CURRENT HYDRANT FLOW TEST DATA, AND MATERIAL DATASHEETS. NO EXCEPTIONS; PIECE-MEAL SUBMISSIONS WILL BE AUTOMATICALLY REJECTED.
5. RESUBMISSIONS MUST BE ACCOMPANIED BY AN ITEMIZED RESPONSE LETTER ON THE FIRE SPRINKLER CONTRACTOR'S LETTER HEAD. EACH REVISION SHALL BE CLOUDED ON PLAN AND THOROUGHLY EXPLAINED IN SAID LETTER. "WILL COMPLY" IS NOT AN ACCEPTABLE ANSWER.
6. WATERFLOW TEST USED FOR PREPARATION OF SYSTEM DESIGN SHALL BE CONDUCTED NO MORE THAN 12 MONTHS PRIOR TO THE CONTRACTOR'S SHOP DRAWING SUBMITTAL. OFFICIAL TEST REPORT FROM WATER PURVEYOR MUST BE INCLUDED WITH THE DRAWING SUBMITTAL. FIRE PUMP TEST SHALL BE USED AS THE WATER SUPPLY TEST.
7. ALL PIPING SHALL BE SIZED BASED ON HYDRAULIC CALCULATIONS. ALL CALCULATIONS SHALL EXTEND TO THE EFFECTIVE POINT OF WATER SUPPLY WHERE THE CHARACTERISTICS OF THE WATER SUPPLY ARE KNOWN. ALL CALCULATIONS SHALL HAVE A MINIMUM SAFETY FACTOR OF 10PSI OR 10% OF THE KNOWN WATER SUPPLY, WHICHEVER IS GREATER.
8. AREAS SUBJECT TO FREEZING SHALL UTILIZE DRY SPRINKLER SYSTEMS.
9. ALL MATERIALS SHALL CONFORM TO THE REQUIREMENTS OF NFPA 13 AND THE PROJECT SPECIFICATIONS.
10. ALL SPRINKLERS SHALL CONFORM TO THE REQUIREMENTS OF NFPA 13, THE AHJ, AND THE PROJECT SPECIFICATIONS. ALL SPRINKLERS SHALL BE QUICK-RESPONSE TYPE, EXCEPT IN AREAS WHERE NOT LISTED FOR USE. ALL SPRINKLERS IN ELEVATOR MACHINE ROOMS, MECHANICAL ROOMS, ELECTRICAL ROOMS AND ELEVATOR SHAFTS SHALL BE INTERMEDIATE TEMPERATURE CLASSIFICATION UNLESS NOTED OTHERWISE. ALL SPRINKLERS IN SHOWER AREAS AND HYDROTHERAPY AREAS TO BE CORROSION RESISTANT.
11. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THE SELECTION OF SPECIFIC APPLICATONS FOR SPRINKLER HEAD TEMPERATURE CLASSIFICATIONS SATSIFIES THE REQUIREMENTS OF NFPA 13 CHAPTER 8.3.2.
12. HANGERS, STRAPS AND CLAMPS SHALL CONSIST OF APPROVED MATERIALS AND SHALL BE INSTALLED IN ACCORDANCE WITH NFPA 13, THE MANUFACTURER'S RECOMMENDATIONS AND UTILIZE UL LISTED OR FM APPROVED COMPONENTS.
13. ALL CONTROL VALVES IN THE SPRINKLER SYSTEM SHALL BE INDICATING TYPE VALVES WITH SUPERVISORY SWITCHES. MAIN ISOLATION VALVE SHALL BE OS&Y TYPE ONLY.
14. SPRINKLER FLOW INDICATORS, CONTROL VALVES, AND DRAIN VALVES MUST BE ACCESSIBLE AND MUST HAVE A NOTIFICATION MARKING TAG INDICATING LOCATION IF THEY ARE CONCEALED ABOVE THE CEILING.
15. ACCEPTANCE TESTS PER NFPA 13 SHALL BE REQUIRED.
16. PROVIDE AUXILIARY DRAINS FOR SYSTEM PIPING FOR PORTIONS OF SYSTEM THAT CANNOT BE DRAINED THROUGH MAIN OR ZONE VALVE ASSEMBLIES IN ACCORDANCE WITH NFPA 13.
17. WATERFLOW AND TAMPER SWITCHES SHALL BE PROVIDED AND INSTALLED BY THE FIRE SPRINKLER CONTRACTOR. THESE DEVICES WILL BE CONNECTED TO THE FIRE ALARM SYSTEM BY THE FIRE ALARM CONTRACTOR. FIRE SPRINKLER CONTRACTOR IS REQUIRED TO COORDINATE LOCATIONS AND PROVIDE FOR TESTING OF SPRINKLER MONITORING DEVICES WITH THE FIRE ALARM CONTRACTOR.
18. SPRINKLER HEAD AND PIPING LOCATIONS SHALL BE COORDINATED WITH ARCHITECTURAL CONDITIONS AND ALL OTHER TRADES PRIOR TO ANY INSTALLATION. DO NOT INSTALL SPRINKLER HEADS OR PIPING DIRECTLY OVER ELECTRICAL EQUIPMENT.
19. SPRINKLERS WITHIN FINISHED AREAS WITH SUSPENDED CEILINGS SHALL BE CONCEALED FLUSH TYPE PENDENT SPRINKLERS. CONTRACTOR SHALL COORDINATE FINISH WITH ARCHITECT AND SUBMIT SAMPLES PRIOR TO PURCHASE AND INSTALLATION. ALL HEADS SHALL BE CENTER OF TILE, ALIGNED AND COORDINATED WITH OTHER FIXTURES.
20. PENETRATION OF FIRE RESISTANCE RATED BARRIERS BY PIPING SHALL BE SEALED BY THE CONTRACTOR WITH A U.L. CLASSIFIED THROUGH PENETRATION SYSTEM CAPABLE OF MAINTAINING THE REQUIRED FIRE RESISTANCE RATING OF THE ASSEMBLY PENETRATED.
21. ALL COMBUSTIBLE CONCEALED AREAS, INCLUDING BUT NOT LIMITED TO ABOVE COMBUSTIBLE CEILINGS OR IN AREAS OF WOODEN FRAMING MEMBERS , SHALL BE SPRINKLERED PER NFPA 13 REQUIREMENTS AND THE AUTHORITY HAVING JURISDICTION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH THE FIRE ALARM CONTRACTOR AND INSPECTORS.
22. CONTRACTOR SHALL COORDINATE INSTALLATION CLOSELY WITH THE OWNER/ARCHITECT/ENGINEER AND SUPPLEMENTAL DETAILS PROVIDED IN THE CONSTRUCTION DOCUMENTS.
23. CONTRACTOR IS RESPONSIBLE FOR FIRE SPRINKLER INSTALLATION ABOVE AND BELOW FLOATING CEILINGS WHERE APPLICABLE PER NFPA 13 AS ENFORCED BY THE AUTHORITY HAVING JURISDICTION. COORDINATE INSTALLATION METHODS CLOSELY WITH THE ARCHITECT'S REFLECTED CEILING PLANS.
24. ALL FIRE PROTECTION GAUGES SHALL COMPLY WITH NFPA 13 CHAPTER 8.17.3 AND SHALL BE INSTALLED IN 3-WAY VALVES WITH THE UNUSED OUTLET PLUGGED.
25. BAFFLE CEILING AREAS SHALL BE PROTECTED PER NFPA 13 CHAPTER 8.15.14 UTILIZING UPRIGHT SPRINKLER HEADS. WHERE HEADS CANNOT BE LOCATED ABOVE CEILINGS TO AVOID SPRAY OBSTRUCTIONS PER NFPA 13, THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ABOVE AND BELOW PROTECTION. LOWER LEVEL HEADS SHALL BE PENDENTS WITH THE DEFLECTOR LOCATED 1" BELOW THE BAFFLE BOTTOM AND PROVIDED WITH SHEILDING PER NFPA 13 CHAPTER 8.5.5.3. COORDINATE SHIELD AND SPRINKLER HEAD COLOR CLOSELY WITH ARCHITECT PRIOR TO INSTALLATION.
26. ALL SPRINKLERS IN BASKETBALL COURTS TO BE PROTECTED BY WIRED CAGES.
27. PENDANT SPRINKLERS INSTALLED ON DRY SYSTEMS TO BE DRY TYPE DROPS INSTALLED ON ARM OVERS.
28. CLOSE-OUT DOCUMENTS SHALL INCLUDE THE FOLLOWING AND/OR EVIDENCE OF COMPLETION FOR THE FOLLOWING, SUBMITTED IN ONE COMPLETE, CONCISE, AND ORGANIZED PACKAGE:
    - COMPLETION OF ALL CONTRACT WORK DOCUMENTED BY A LETTER OF COMPLETION ON THE SPRINKLER CONTRACTOR'S COMPANY LETTERHEAD SIGNED BY THE ACTIVE PRESIDENT OF THE ORGANIZATION
    - A WARRANTY LETTER DETAILING THE SCOPE, DURATION, AND EXTENTS OF THE WARRANTY AS DETAILED IN THE PROJECT SPECIFICATIONS.
    - SUCCESSFUL COMPLETION OF ALL INSPECTIONS BY THE AHJ.
    - CLOSEOUT OF ALL PERMITS
    - COMPLETION OF ALL PUNCHLIST ITEMS
    - OWNER TRAINING
    - SUBMISSION OF O&M MANUALS FOR EACH PIECE OF EQUIPMENT INSTALLED UNDER THIS CONTRACT
    - SUBMISSION OF ALL AS-BUILT DRAWINGS
    - COPIES OF ALL PERMITS
    - COPIES OF INSPECTION REPORTS INCLUDING NFPA 13, 14, 20, AND 25
    - COPIES OF ALL INSPECTION STICKERS
    - FINAL CLEAN UP OF ALL MATERIALS, EQUIPMENT, AND TOOLS
    - FINAL WALK THROUGH WITH THE OWNER

NOTE: PROJECT CLOSEOUT ITEMS LISTED ABOVE SHALL BE SUBMITTED IN A TABBED AND INDEXED BINDER. BINDER SHALL INCLUDE A TABBED DUPLICATE DIGITAL COPY. INCOMPLETE AND/OR UNORGANIZED SUBMISSIONS WILL BE AUTOMATICALLY REJECTED.

SPRINKLER SYSTEM DESIGN CRITERIA

1. LIGHT HAZARD OCCUPANCIES:
   SYSTEMS SHALL BE DESIGNED AND CALCULATED AT 0.10 GPM/SQ. FT. OVER A REMOTE AREA OF 1500 SQ. FT. PLUS A COMBINED HOSE FLOW OF 100 GPM AND LEAVING A MINIMUM 10% OR 10PSI SAFETY FACTOR, WHICHEVER IS GREATER. MAXIMUM AREA PER SPRINKLER SHALL BE 225 SQ. FT.
2. ORDINARY HAZARD GROUP I OCCUPANCIES:
   SYSTEMS SHALL BE DESIGNED AND CALCULATED AT 0.15 GPM/SQ. FT. OVER A REMOTE AREA OF 1500 SQ. FT. PLUS A COMBINED HOSE FLOW OF 250 GPM AND LEAVING A MINIMUM 10% OR 10PSI SAFETY FACTOR, WHICHEVER IS GREATER. MAXIMUM AREA PER SPRINKLER SHALL BE 130 SQ. FT..
3. ORDINARY HAZARD GROUP II OCCUPANCIES:
   SYSTEMS SHALL BE DESIGNED AND CALCULATED AT 0.20 GPM/SQ. FT. OVER A REMOTE AREA OF 1500 SQ. FT. PLUS A COMBINED HOSE FLOW OF 250 GPM AND LEAVING A MINIMUM 10% OR 10PSI SAFETY FACTOR, WHICHEVER IS GREATER. MAXIMUM AREA PER SPRINKLER SHALL BE 130 SQ. FT.

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SYMBOLS, ABBREVIATIONS AND NOTES

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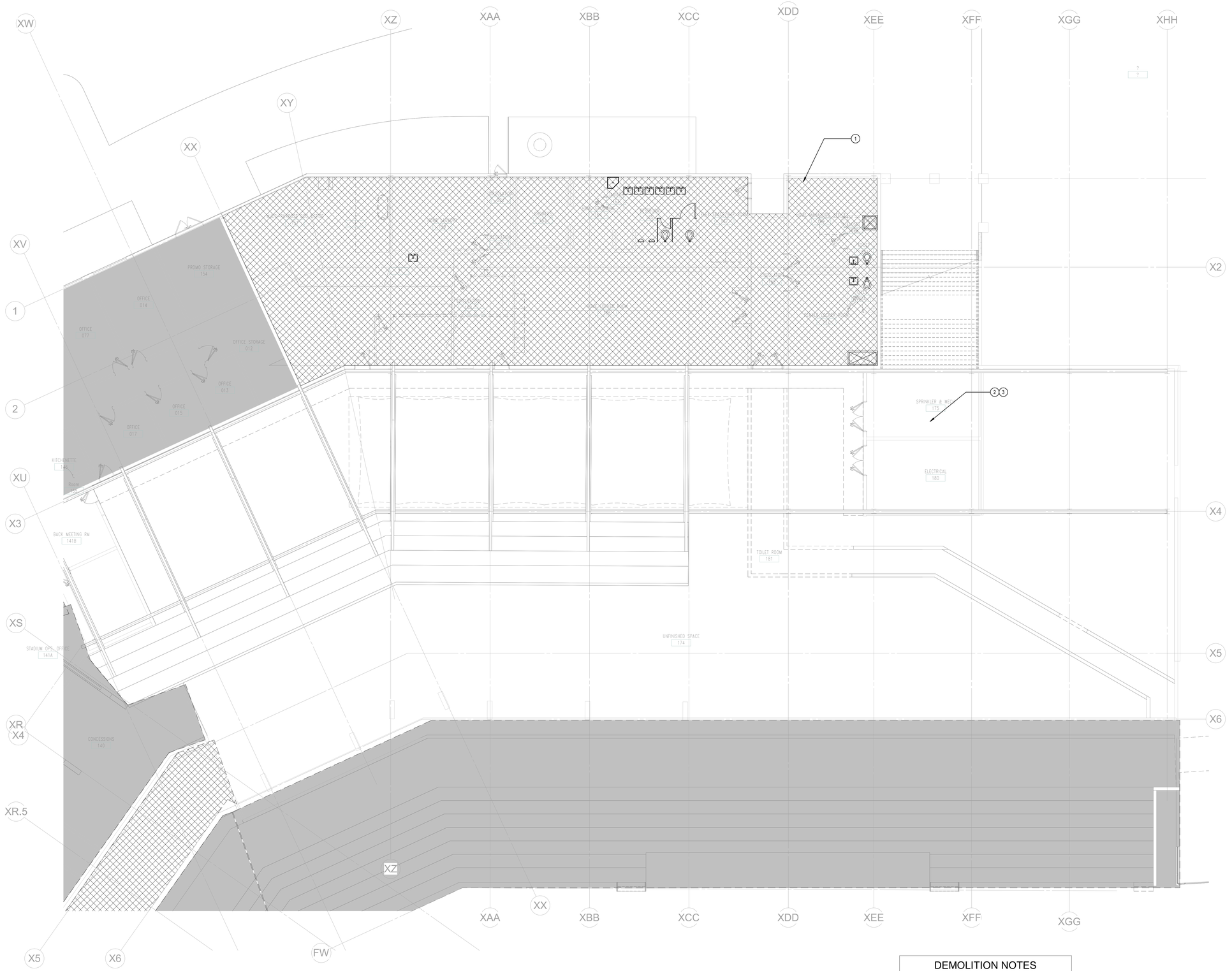

DEMOLITION NOTES

1. DEMO ALL SPRINKLER PIPE, FITTINGS, HEADS AND HANGERS IN HATCHED AREA BACK TO POINT OF CONNECTION INTO SPACE. CAP OFF USUCH THAT REMAINDER OF SYSTEM REMAINS IN OPERATION DURING CONSTRUCTION. AREA FED BY WET PIPE SYSTEM - LOCATION OF ZONE CONTROLS, IF PRESENT, UNKNOWN.
2. LOCATION OF EXISTING FIRE PUMP ROOM.
3. DEMO EXISTING JOCKEY PUMP.

1 HOME CLUBHOUSE DEMO PLAN - FIRE PROTECTION
SCALE: 1/8" = 1'-0"

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

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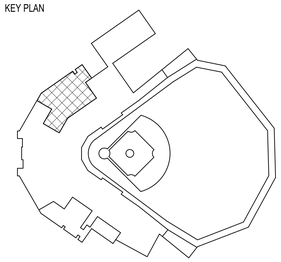

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HOME CLUBHOUSE - DEMO PLAN - FIRE PROTECTION

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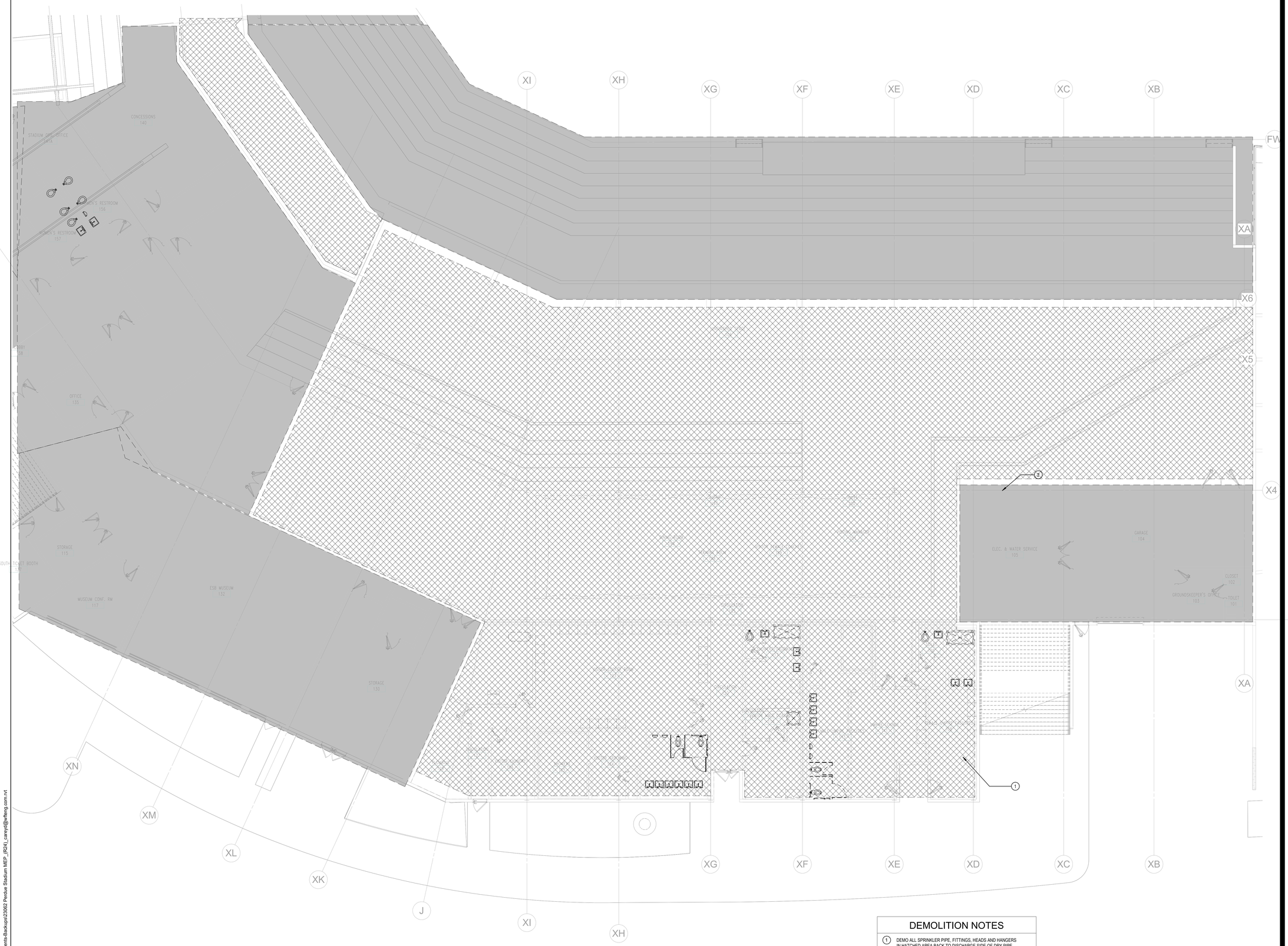

DEMOLITION NOTES

1. DEMO ALL SPRINKLER PIPE, FITTINGS, HEADS AND HANGERS IN HATCHED AREA BACK TO DISCHARGE SIDE OF DRY PIPE VALVE IN ADJACENT ELEC AND WATER SERVICE ROOM.
2. LOCATION OF DRY PIPE VALVE.

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

1 VISITOR CLUBHOUSE DEMO PLAN - FIRE PROTECTION

SCALE: 1/8" = 1'-0"

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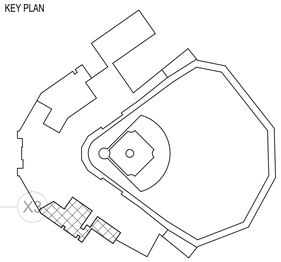

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VISITOR CLUBHOUSE - DEMO PLAN - FIRE PROTECTION

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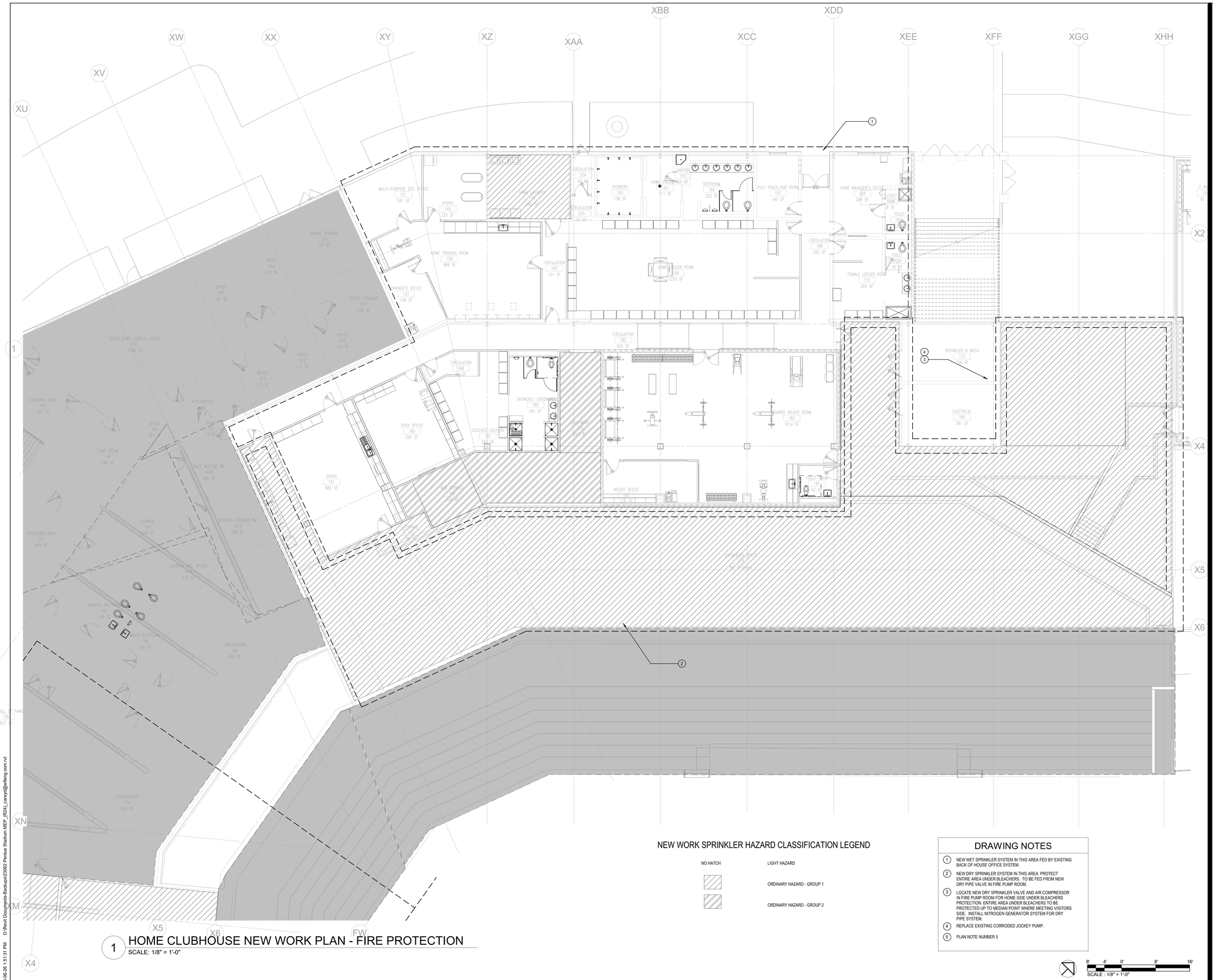

1 HOME CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION

SCALE: 1/8" = 1'-0"

NEW WORK SPRINKLER HAZARD CLASSIFICATION LEGEND

NO HATCH	LIGHT HAZARD
	ORDINARY HAZARD - GROUP 1
	ORDINARY HAZARD - GROUP 2

DRAWING NOTES

1. NEW WET SPRINKLER SYSTEM IN THIS AREA FED BY EXISTING BACK OF HOUSE OFFICE SYSTEM.
2. NEW DRY SPRINKLER SYSTEM IN THIS AREA. PROTECT ENTIRE AREA UNDER BLEACHERS. TO BE FED FROM NEW DRY PIPE VALVE IN FIRE PUMP ROOM.
3. LOCATE NEW DRY SPRINKLER VALVE AND AIR COMPRESSOR IN FIRE PUMP ROOM FOR HOME SIDE UNDER BLEACHERS PROTECTION. ENTIRE AREA UNDER BLEACHERS TO BE PROTECTED UP TO MEDIAN POINT WHERE MEETING VISITORS SIDE. INSTALL NITROGEN GENERATOR SYSTEM FOR DRY PIPE SYSTEM.
4. REPLACE EXISTING CORRODED JOCKEY PUMP.
5. PLAN NOTE NUMBER 5

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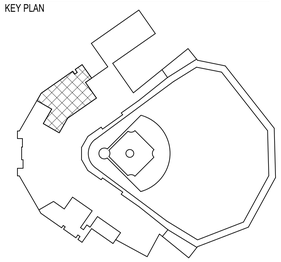
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



PRINCIPAL
DG
PROJECT MANAGER
TR
Project Architect
SN
Project Model Lead
SN

REVISIONS

NO.	BY	DESCRIPTION	DATE
D	WFT	ISSUE 4: CONSTRUCTION DOCUMENTS	6/21/24
B	WFT	ISSUE 2: DESIGN DEVELOPMENT	5/9/24

ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION

PHASE CD

DRAWING NO. FP1.1.1

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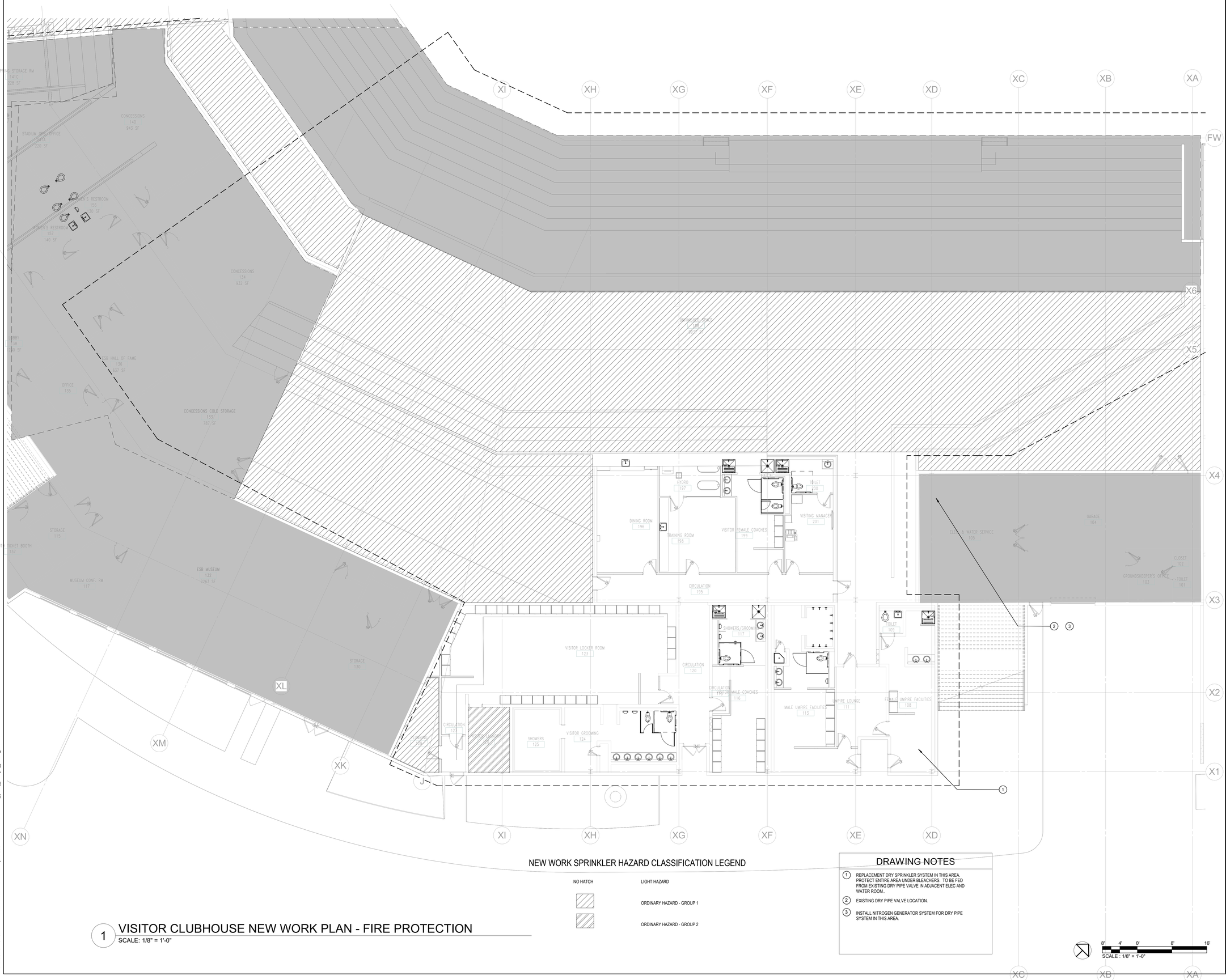


NEW WORK SPRINKLER HAZARD CLASSIFICATION LEGEND

NO HATCH	LIGHT HAZARD
	ORDINARY HAZARD - GROUP 1
	ORDINARY HAZARD - GROUP 2

DRAWING NOTES

1. REPLACEMENT DRY SPRINKLER SYSTEM IN THIS AREA. PROTECT ENTIRE AREA UNDER BLEACHERS. TO BE FED FROM EXISTING DRY PIPE VALVE IN ADJACENT ELEC AND WATER ROOM.
2. EXISTING DRY PIPE VALVE LOCATION.
3. INSTALL NITROGEN GENERATOR SYSTEM FOR DRY PIPE SYSTEM IN THIS AREA.

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

1 VISITOR CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION

SCALE: 1/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986
351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE
810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

Gilbane
The Liberty Building at McHenry Row
1215 E Fort Avenue #100
Baltimore, MD 21230
Tel: 410-649 1750

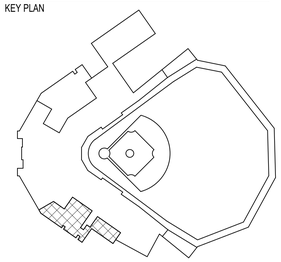
STRUCTURAL ENGINEER
EWINGCOLE

CIVIL ENGINEERS & LANDSCAPE DESIGN
SURVEY/ GEOTECH/ UTILITY INVESTIGATION
McCRONE ENGINEERING

MEPFP ENGINEERS
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

VISITOR CLUBHOUSE NEW WORK PLAN - FIRE PROTECTION

PHASE CD

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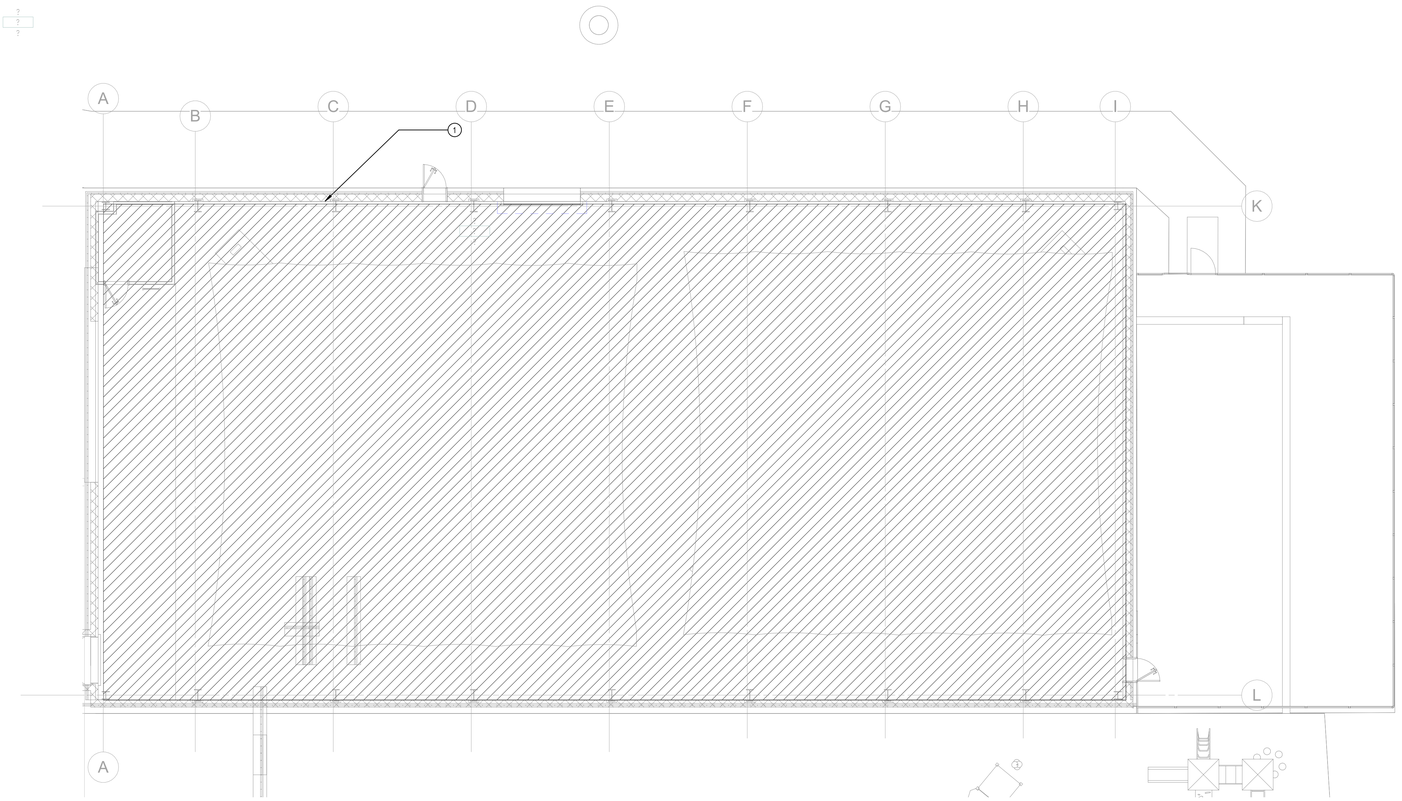

1 HOME CLUBHOUSE BATTING ARENA PLAN - FIRE PROTECTION

SCALE: 1/8" = 1'-0"

NEW WORK SPRINKLER HAZARD CLASSIFICATION LEGEND

NO HATCH	LIGHT HAZARD
	ORDINARY HAZARD - GROUP 1
	ORDINARY HAZARD - GROUP 2

DRAWING NOTES

1. INSTALL NEW DRY PIPE SPRINKLER SYSTEM. LOCATE DRY PIPE VALVE AND AIR COMPRESSOR IN FIRE PUMP ROOM. ROUTE FEED MAIN FROM DRY PIPE VALVE TO BATTING ARENA BUILDING THRU CONDITIONED SPACE.
2. INSTALL NITROGEN GENERATOR FOR BOTH DRY SPRINKLER SYSTEMS PROTECTING THE BATTING ARENA BUILDING AND SYSTEM UNDER THE BLEACHERS.

8' 4' 0' 8' 16'
SCALE : 1/8" = 1'-0"

MARYLAND STADIUM AUTHORITY
Est. 1986

351 West Camden Street
Suite # 300
Baltimore, MD 21201
Tel: 410-333 1560

EWING COLE

810 Light Street
Baltimore, MD 21230-3970
Tel: 410-837-5040 Fax: 410-234-8010

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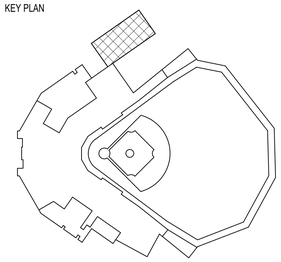
WFT ENGINEERING, INC

ACOUSTIC & AV CONSULTANT
CONVERGENT TECHNOLOGIES DESIGN GROUP

KEY PLAN



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ARTHUR W. PERDUE STADIUM IMPROVEMENTS

6400 HOBBS ROAD,
SALISBURY, MD, 21804

DRAWN BY WFT DATE

EC/WFT PROJ NO. 20230573/23062 SCALE 1/8" = 1'-0"

DRAWING NAME

HOME CLUBHOUSE BATTING ARENA PLAN - FIRE PROTECTION

PHASE
CD

DRAWING NO.
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ATTACHMENT J.2
70% SPECIFICATIONS

Project Manual

Maryland Stadium Authority

Arthur W. Perdue Stadium Improvements

6400 Hobbs Road

Salisbury, MD 21804

70% Construction Documents

June 21, 2024

Gilbane | InSite BUILD | EWING COLE

SECTION 000110

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SECTION 011000

SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: Arthur W. Perdue Stadium Improvement

B. Owner's Name: Maryland Stadium Authority.

C. Architect's Name: EwingCole.

D. Additional Project contact information is specified in Section 000103 - Project Directory.

E. The Project consists of the improvement of Arthur W. Perdue Stadium

A. Owner intends to occupy the Project by the date stated in the Agreement as the contract completion date.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Arrange use of site and premises to allow:

1. Work by Others.
2. Work by Owner.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions:

1. Limit conduct of especially noisy exterior work to the hours of _____.

E. Utility Outages and Shutdown:

1. Limit shutdown of utility services to 4 hours at a time, arranged at least 24 hours in advance with Owner.
2. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
   a. Unavailability.
   b. Regulatory changes.
2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
   a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
2. Agrees to provide the same warranty for the substitution as for the specified product.
3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
5. Waives claims for additional costs or time extension that may subsequently become apparent.
6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. A Substitution Request for specified installer constitutes a representation that the submitter:

1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

1. Note explicitly any non-compliant characteristics.

D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
2. No specific form is required. Contractor's Substitution Request documentation must include the following:
    a. Project Information:
        1) Official project name and number, and any additional required identifiers established in Contract Documents.
        2) Owner's, Architect's, and Contractor's names.
    b. Substitution Request Information:
        1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
        2) Indication of whether the substitution is for cause or convenience.
        3) Issue date.
        4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
        5) Description of Substitution.
        6) Reason why the specified item cannot be provided.
        7) Differences between proposed substitution and specified item.
        8) Description of how proposed substitution affects other parts of work.
    c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
        1) Physical characteristics.
        2) In-service performance.
        3) Expected durability.
        4) Visual effect.
        5) Sustainable design features.
        6) Warranties.
        7) Other salient features and requirements.
        8) Include, as appropriate or requested, the following types of documentation:
            a) Product Data:
            b) Samples.
            c) Certificates, test, reports or similar qualification data.
            d) Drawings, when required to show impact on adjacent construction elements.
    d. Impact of Substitution:
        1) Savings to Owner for accepting substitution.
        2) Change to Contract Time due to accepting substitution.

E. Limit each request to a single proposed substitution item.

1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:

1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):

1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):

1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Architect will consider requests for substitutions only within 15 days after date of Agreement.

C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
3. Bear the costs engendered by proposed substitution of:
    a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

E. Substitutions will not be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.5 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 013000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service. **haring**] service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Contractor's daily reports.

H. Progress photographs.

I. Coordination drawings.

J. Submittals for review, information, and project closeout.

K. Number of copies of submittals.

L. Requests for Interpretation (RFI) procedures.

M. Submittal procedures.

1.2 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Interpretation (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.

8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based service that receives, logs and stores documents, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Cost: The cost of the service will be paid by Contractor

F. Submittal Service Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

G. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.2 PRECONSTRUCTION MEETING

3.3 SITE MOBILIZATION MEETING

A. Schedule meeting at the project site prior to Contractor occupancy.

D. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Special consultants.
5. Contractor's superintendent.
6. Major subcontractors.

E. Agenda:

1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

F. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

E. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Special consultants.
5. Contractor's superintendent.
6. Major subcontractors.

F. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

G. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.5 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.6 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. In addition to transmitting electronically a copy to Owner and Architect, submit two printed copies at weekly intervals.

1. Submit in format acceptable to Owner.

C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:

1. Date.
2. High and low temperatures, and general weather conditions.
3. List of subcontractors at Project site.
4. List of separate contractors at Project site.
5. Approximate count of personnel at Project site.
    a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
6. Major equipment at Project site.
7. Material deliveries.
8. Safety, environmental, or industrial relations incidents.
9. Meetings and significant decisions.
10. Unusual events (submit a separate special report).
11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
12. Meter readings and similar recordings.
13. Emergency procedures.

14. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
15. Change Orders received and implemented.
16. Testing and/or inspections performed.
17. List of verbal instruction given by Owner and/or Architect.
18. Signature of Contractor's authorized representative.

3.7 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.

C. Photography Type: Digital; electronic files.

D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

E. In addition to periodic, recurring views, take photographs of each of the following events:

1. Structural framing in progress and upon completion.
2. Enclosure of building, upon completion.
3. Final completion, minimum of ten (10) photos.

F. Views:

1. Provide aerial photographs from four cardinal views at each specified time.
2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
3. Consult with Architect for instructions on views required.
4. Provide factual presentation.
5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.

1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

H. Photographer Quality Prints: Full color; three prints of each view.

1. Glossy; smooth texture; white tint; single weight; high contrast.
2. Size: 8 by 10 inch; mounted for binder and tabs.
3. Identify each print on back. Identify name of Project, contract number, phase, orientation of view, date and time of view, name and address of photographer, and photographer's numbered identification of exposure.

3.8 COORDINATION DRAWINGS

A. Review drawings prior to submission to Architect.

3.9 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.
   a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
   b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Owner.
3. [Prepare using software provided by the Electronic Document Submittal Service]

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
   a. Approval of submittals (use procedures specified elsewhere in this section).
   b. Approval of substitutions (see Section - 016000 - Product Requirements)

c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.

4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular

working day.

1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.10 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:

1. Product data.
2. Design data.
3. Shop drawings.
4. Samples for selection.
5. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.12 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:

1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 017800.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.15 SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a separate transmittal for each item.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.

3. Transmit using approved form.
   a. Use form generated by Electronic Document Submittal Service Software.
4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Upload submittals in electronic form to Electronic Document Submittal Service website.

6. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

12. Submittals not requested will be recognized, and will be returned "Not Reviewed"

B. Product Data Procedures:

1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

3.16 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:

1. Authorizing purchasing, fabrication, delivery, and installation:
   a. "Approved", or language with same legal meaning.
   b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
      1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
   c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.

1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2) Non-responsive resubmittals may be rejected.

2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit".
      1) Resubmit revised item, with review notations acknowledged and incorporated.
      2) Non-responsive resubmittals may be rejected.
   b. "Rejected".
      1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
   a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 013216

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.2 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit in PDF format.

G. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

H. Submit one reproducible transparency and one opaque reproduction.

I. Submit under transmittal letter form specified in Section 013000 - Administrative Requirements.

1.3 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.2 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Include conferences and meetings in schedule.

F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

H. Indicate delivery dates for owner-furnished products.

I. Coordinate content with schedule of values specified in Section 012000 - Price and Payment Procedures.

J. Provide legend for symbols and abbreviations used.

3.3 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.4 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.5 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.6 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 013553

SECURITY PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.2 SECURITY PROGRAM

A. Protect Work and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.3 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site .

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to Owner on request.

D. Owner will control entrance of persons and vehicles related to Owner's operations.

1.4 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number , expiration date and employer.

C. Require return of badges at expiration of their employment on the Work.

C. Require return of badges at expiration of their employment on the Work.

1.6 RESTRICTIONS

A. Do not allow cameras on site or photographs taken except by written approval of Owner.

B. Do no work on Sundays.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 014000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.2 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:
   a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
   b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.3 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:

1. Temporary sheeting, shoring, or supports.
2. Temporary scaffolding.
3. Temporary bracing.
4. Temporary hoist(s) and rigging.

1.4 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: As indicated on the individual specification sections.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.

a. Full name.
b. Professional licensure information.
c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Include:
   a. Date issued.
   b. Project title and number.
   c. Name of inspector.
   d. Date and time of sampling or inspection.
   e. Identification of product and specifications section.
   f. Location in the Project.
   g. Type of test/inspection.
   h. Date of test/inspection.
   i. Results of test/inspection.
   j. Compliance with Contract Documents.
   k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:

1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
   a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
      1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
   b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
      1) Management and control of documents and records relating to quality.
      2) Communications.
      3) Coordination procedures.
      4) Resource management.
      5) Process control.
      6) Inspection and testing procedures and scheduling.
      7) Control of noncomplying work.
      8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
      9) Control of testing and measuring equipment.
      10) Project materials certification.
      11) Managerial continuity and flexibility.
   c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
   d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional

and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.7 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.8 TESTING AND INSPECTION AGENCIES AND SERVICES

A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Notify Architect and Owner fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
2. Make corrections as necessary until Architect's approval is issued.

J. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

L. Where possible salvage and recycle the demolished mock-up materials.

3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

1. Observer subject to approval of Architect and Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 41 00.00

TESTING AND INSPECTION SERVICES (For Information Only)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes Code Mandated Special Inspection requirements and other Owner Provided Inspections and Related Testing Requirements. Section also includes administrative and procedural requirements for Testing and inspecting services.

B. Owner will employ and pay for the services of an Independent Testing Agency and Geotechnical Engineering Consultant to perform certain specified testing as listed hereinafter:

1. Employment of the Testing Agency and Geotechnical Engineer shall in no way relieve Contractor's obligations to perform the Work of the Contract.
2. Special Inspections in accordance with Chapter 17 of the IBC 2015.

C. Contractor shall employ and pay for the services of an Independent Testing Agency and Geotechnical Engineer to perform all other specified services and testing not included herein, and the retesting of “failed” areas.

1.3 DEFINITIONS

A. Approved Fabricator: An established and qualified person, firm or corporation approved by the building official pursuant to Chapter 17 of IBC 2015. One who has received approval to perform work without a code-required special inspection for work performed in the shop.

B. Approved Testing and Inspection Agency/Special Inspection Administrator: Owner hired, objective, competent and independent from the contractor responsible for the work being inspected. An established and recognized agency capable of and regularly engaged in conducting tests and furnishing inspection services, when such agency has been approved by the building code official. The approved agency shall perform all duties for testing and inspection requirements noted herein.

C. Geotechnical Engineer: A Professional Engineer, with expertise in soil mechanics and foundations, approved by the building code official to perform special inspections. The geotechnical engineer is considered a specialized individual within the Testing and Inspection Agency and all requirements for the Testing and Inspection Agency shall apply to that individual. It is recommended that the Geotechnical Engineer for this specification be the same Geotechnical Engineer of Record who generated the geotechnical report for the project.

D. Special Inspection: Inspection as herein required of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure

compliance with approved construction documents. Refer to Schedule of Special Inspection Services section of this specification for requirements.

E. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.

F. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work. Refer to material sections for additional criteria.

G. Special Inspector: A qualified person, employed by the Testing and Inspection Agency, who shall demonstrate competence, to the satisfaction of the building code official, for the inspection of the particular type of construction or operation requiring *special inspection*. Refer to "Key for Minimum Qualifications of Inspection Agents" preceding the Schedule of Special Inspection Services section of this specification.

1.4 QUALIFICATION OF TESTING AND INSPECTION AGENCY

A. The Testing and Inspection Agency shall, in addition to meeting requirements noted in the 'Definitions' section, meet one of the requirements below:

1. Maintains current accreditation as a special inspection agency by the International Accreditation Service (IAS) within the scope of accreditation issued by IAS or other approval entity as determined by the building code official.
2. Meet basic requirements of ASTM E329, "Standard Specification for Agencies engaged in Construction Inspection and/or Testing.
3. Accredited in accordance with ISO/IEC 17020 (International Organization for Standardization/International Electro-technical Commission - The General Criteria for the Operation of Various Types of Bodies Performing Inspection)

B. Authorized to operate in the State of Maryland.

C. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Institute of Standards and Technology during the most recent tour of inspection, with memorandum of remedies of any deficiencies reported by the inspection.

D. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either:

1. National Institute of Standards and Technology (NIST)
2. Accepted values of natural physical constants.

E. Special inspections shall meet the minimum qualifications listed in the attached Schedule of Special Inspections or as required by the building code official.

1.5 TESTING AND INSPECTION AGENCY RESPONSIBILITIES

A. Testing and inspections shall be performed under the direction of Licensed Professional Engineer registered in the State of Maryland who shall be responsible for administering all testing and inspections and shall certify any local agency requirements.

C. Cooperate with Architect and Contractor; provide qualified personnel after due notice.

D. Provide written documentation to the building code official demonstrating competence and relevant experience or training when required by local jurisdiction.

E. Perform all tests and inspections required by the Statement of Special Inspections.

F. Perform specified inspections, sampling and testing of materials and methods of construction:

1. Comply with specified standards.
2. Ascertain compliance of materials with requirements of Contract Documents.

G. If during the excavation for foundations, materials are encountered which vary from those indicated by the test boring data or the Contract Documents or if there are any unusual conditions observed when concrete for foundations is placed, the Geotechnical Engineer shall IMMEDIATELY advise the Owner to stop all related work until the Architect has been notified of such conditions.

H. Should any material be delivered to the site which does not conform to the requirements of the Contract Documents, the Inspection Agency or Geotechnical Engineer shall have the authority to reject such material and shall IMMEDIATELY notify the Owner, Contractor and Architect of such rejection.

I. Should Laboratory tests of material performed at specified intervals of time indicate that strengths do not meet Specification requirements, the Inspection Agency or Geotechnical Engineer shall IMMEDIATELY notify the Owner, Contractor and Architect. The Architect shall determine whether remedial action is necessary.

J. Establish and maintain appropriate communications with the Owner, Architect/Engineer, Contractor, and the building code official regarding the Inspection process. Promptly submit written report of each test and inspection; electronic copy each to Architect, Owner, and Contractor. Provide copy to building code official when required by local jurisdiction. Each report shall include:

1. Date issued
2. Project title and number
3. Testing laboratory name, address and telephone number
4. Name and signature of laboratory inspector
5. Date and time of sampling or inspection
6. Record of temperature and weather conditions
7. Date of test
8. Identification of product and Specification section
9. Type of inspection or test
10. Results of tests and compliance with Contract Documents
11. Interpretation of test results

K. Prepare a summary report for each category of inspection certifying that the work has been inspected and meets the Contract Documents. Specifically list all discrepancies found which have not yet been repaired or resolved and bring to the attention of the building code official and registered design professional in responsible charge prior to completion of that phase of work.

L. Monitor the work of the contractor to assess actions required to correct deficiencies reported in Special Inspection reports.

M. Perform additional tests as required by Architect or the Owner.

N. Prepare a Final Report of Special Inspections and submit to the building code official, upon completion of construction, stating that the Special Inspections were completed, and that all discrepancies have been corrected.

1.6 LIMITATIONS OF AUTHORITY OF TESTING AND INSPECTION AGENCY

A. The Testing and Inspection Agency is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents
2. Approve or accept any portion of the Work
3. Perform any duties of the Contractor

1.7 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with Testing and Inspection Agency, provide access to Work.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which are required to be tested.

C. Provide to the laboratory the preliminary and final design mixes proposed to be used for concrete and other materials mixes which are required to be controlled by the testing laboratory.

D. Furnish copies of Products test reports as required.

E. Furnish incidental labor and facilities:

1. To provide access to Work to be tested
2. To obtain and handle samples at the Project site or at the source of the product to be tested
3. To facilitate inspections and tests
4. For storage and curing of test samples

F. Notify Testing and Inspection Agency and Architect sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Notification shall be a minimum of three working days (72 hours) for required shop testing and two working days (48 hours) for required field testing. When tests or inspections cannot be performed after such notice, reimburse Owner for testing personnel and travel expenses incurred due to Contractor's negligence.

G. Make arrangements with laboratory and pay for additional samples and tests required:

1. When initial test indicates work does not comply with Contract Documents.
2. For the Contractor's convenience.
3. For inspection and testing services required, but not included herein.

1.8 SPECIFIC TESTS, INSPECTIONS BY OWNER'S TESTING AND INSPECTION AGENCY

A. Testing and Inspection of Poured in Place Concrete Work (Division 03)

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231, pressure method, for normal-weight concrete: one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F. and below and when 80 deg F. and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M.
6. Cast five sets of two standard cylinders for each composite sample.

    a. Laboratory cure three sets of two standard cylinder specimens.
    b. Field cure two sets of two standard cylinder specimens.

        1) Remove test specimens from molds at end of 24 hours and store in structure as near point of placement as possible; maintain conditions similar to those portions of structure that they represent.
        2) Do not remove from structure for transmittal to laboratory prior to expiration of three-fourths of proposed period before removal of forms.

7. Compressive-Strength Tests: ASTM C39/C39M

    a. Test laboratory-cured specimens as follows:

        1) One set of two specimens at 7 days.
        2) One set of two specimens at 28 days.
        3) Hold one set of two specimens in reserve. Test when directed by the Architect.

    b. Test field-cured specimens as follows:

        1) One set of two specimens at an age determined by the Contractor for form stripping, but not later than 7 days.
        2) One set of two specimens at 28 days.

    c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Tests of Hardened Concrete in, or Removed From, Structures

    a. Where there is question as to quality of concrete in structure, the Architect may require tests per ASTM C42, or order load tests for that portion of structure where questionable concrete has been placed.
    b. Where required, load test shall be made at Contractor's expense, per Section 202 of ACI 318.
    c. In event that load tests or test per ASTM C42 indicate that concrete placed does not conform to Contract Documents take measures as prescribed by the Architect to correct deficiency at no additional expense to the Owner.

11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete as directed by Architect when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met; and when Work is repaired or replaced. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect. Additional testing and inspecting shall be performed at the Contractor's expense.

B. Testing and Inspection of Masonry (Division 04)

1. Perform testing and inspection in accordance with Level 2.
2. Compressive strength of masonry (f'm) shall be determined by the Unit Strength Method.
3. Review mix designs for masonry mortars, grouts and concrete.
4. Perform visual inspection in the field of the masonry units, reinforcing, proportioning mixing and consistency of mortars and grout, and general compliance with the Contract Documents.

C. Testing and Inspection of Structural Steel (Division 05)

1. Special Inspections of shop fabricated elements required by IBC Section 1705 shall not be required where the fabricator is approved in accordance with IBC 1704.2.5.2.
2. In addition to visual inspection, shop and field-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

    a. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360- degree flash or welding repairs to any shear connector.

3. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.
4. Frequency of Testing of Welds:

    a. Test all full penetration welds using X-ray or ultrasonic methods. Test 50% of all partial penetration welds by a nondestructive method at the discretion of the Inspection Agency. Test 25% of all fillet welds by a nondestructive method at the discretion of the Inspection Agency. Any improper welding shall be corrected by the Contractor and tested by the Inspection Agency at no expense to the Owner. Any improper welding found shall be corrected by the Contractor and an additional 15% of the welds shall be tested by the Owner's Inspection Agency at no expense to the Owner.
    b. If a disproportionate number of improper welds (5%) occurs in the additional 15% tested, all welding operations shall be halted temporarily and not resumed until welding procedures are reviewed and corrected by the Contractor and accepted by the Architect and the Owner's Inspection Agency. All corrective work and testing shall be at the Contractor's expense.

5. Frequency of Inspection of Bolted Connections

    a. For high strength bolts in bearing type connections installed with a prescribed pretension, inspection shall include a visual examination of <u>all</u> bolts, plus a check by use of a calibrated torque wrench on at least 15% of bolts (minimum 2 bolts) in each particular connection. If any bolt tested does not meet the Specification requirements, <u>all</u> bolts in the connection shall be retightened and retested.

D. Testing and Inspection of Metal Decking and Forms (Division 05)

1. Perform all field inspection in connection with the installation of the metal decking and forms in accordance with Schedule of Special Inspection Services.

E. Testing and Inspection of Cold-Formed-Metal-Framing (Division 05)

1. Perform all inspections in connection with the fabrication and installation of cold-formed-metal-framing in accordance with Schedule of Special Inspection Services.

F. Testing and Inspection of Metal Fabrications (Division 05)

1. Perform all inspections in connection with the fabrication and installation of metal fabrications in accordance with Schedule of Special Inspection Services.
2. Frequency of Test of Welds:

    a. Full Penetration Welds: Test all full penetration welds using X-ray or ultrasonic methods.
    b. Partial Penetration Welds: Test 50% of all partial penetration welds by a nondestructive method at the discretion of the Inspection Agency.
    c. Primary Fillet Welds: Test 25% of all fillet welds used for connections of channels, angles, or load carrying members by a nondestructive method at the discretion of the Inspection Agency.
    d. Secondary Fillet Welds: Test 15% of all fillet welds used for connections of handrails by a nondestructive method at the discretion of the Inspection Agency. Test 10% of all fillet welds used for connections of grating or secondary components by a nondestructive method at the discretion of the Inspection Agency.
    e. Any improper welding found shall be corrected by the Contractor and an additional 15% of the welds shall be tested by the Owner's Inspection Agency at no expense to the Owner. If a disproportionate number of improper welds (5%) occurs in the additional 15% tested, all welding operations shall be halted temporarily and not resumed until welding procedures are reviewed and corrected by the Contractor and accepted by the Architect and the Owner's Inspection Agency. All corrective work and testing shall be at the Contractor's expense.

G. Testing and Inspection of Metal Stairs and Railings (Division 05) and Decorative Metal Railings (Division 05)

1. Perform all inspections in connection with the fabrication and installation of metal stairs and railings and decorative metal railings in accordance with Schedule of Special Inspection Services.
2. Frequency of Test of Welds:

    a. Full Penetration Welds: Test all full penetration welds using X-ray or ultrasonic methods.
    b. Partial Penetration Welds: Test 50% of all partial penetration welds by a nondestructive method at the discretion of the Inspection Agency.
    c. Primary Fillet Welds: Test 25% of all fillet welds used for connections of channels, angles, or load carrying members by a nondestructive method at the discretion of the Inspection Agency.
    d. Secondary Fillet Welds: Test 15% of all fillet welds used for connections of handrails by a nondestructive method at the discretion of the Inspection Agency. Test 10% of all fillet welds used for connections of grating or secondary components by a nondestructive method at the discretion of the Inspection Agency.
    e. Any improper welding found shall be corrected by the Contractor and an additional 15% of the welds shall be tested by the Owner's Inspection Agency at no expense

to the Owner. If a disproportionate number of improper welds (5%) occurs in the additional 15% tested, all welding operations shall be halted temporarily and not resumed until welding procedures are reviewed and corrected by the Contractor and accepted by the Architect and the Owner's Inspection Agency. All corrective work and testing shall be at the Contractor's expense.

3. Frequency of Testing: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed work. Railings will be tested according to ASTM E894 and ASTM E935 for compliance with performance requirements.
4. Contractor shall correct unacceptable work and pay for further testing (by Owner's Testing Agency) required to prove acceptability of installation.

H. Inspection and monitoring storm water runoff from site (Division 31)

1. Inspect erosion and sediment control installation measures.
2. Monitor throughout the construction period to verify the appropriate effectiveness of the erosion and sediment control measures.

I. Testing and Inspection of Earthwork (Division 31)

1. Submit Material Test Report: Laboratory compaction curve according to ASTM D698 for each soil material proposed for fill and backfill.
2. Test Frequency:

   a. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
   b. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
   c. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
   d. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

J. Testing and Inspection of Aggregate Piers for Ground Improvement (Division 31)

1. Testing and inspection of Aggregate Piers for ground improvement shall be performed by the specialty contractor required for the design in accordance with specification section 316000.

END OF SECTION

STATEMENT OF SPECIAL INSPECTIONS

Project:	Arthur W. Perdue Stadium Improvements
Location:	6400 Hobbs Road, Salisbury, MD 21804
Owner:	Maryland Stadium Authority
Owner's Address:	351 West Camden Street Suite #300 Baltimore, MD 21201
Architect of Record:	EwingCole
Structural Engineer of Record:	EwingCole
Building Code:	International Building Code 2015 (IBC 2015)

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the International Building Code. It includes a Schedule of Special Inspection Services applicable to this project as well as the name of the Special Inspections Administrator and the identity of other approved agencies intended to be retained for conducting these inspections.

The Special Inspections Administrator shall keep records of all inspections and shall furnish inspection reports to the Building Official, Structural Engineer of Record and Architect of Record. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official, Structural Engineer of Record and Architect of Record. The Special Inspection program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted on a WEEKLY basis to the Building Official, Owner, Structural Engineer of Record and Architect of Record.

A Final Report of Special Inspections documenting completion of all required Special Inspections and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy.

Job site safety and means and methods of construction are solely the responsibility of the Contractor.

Prepared by:

(Type or Print Name)

Signature Date

Owner's Authorization:

Signature Date

Building Official's Acceptance:

Signature Date

The following sheets contain the required schedule of special inspections services for this project.

(Agent No.) Inspection Agents	Firm	Address
1. Special Inspections Administrator	To be hired by the owner	
2. Testing Laboratory and Field Inspector	To be hired by the owner	
3. Geotechnical Engineer	To be hired by the owner	
4. Other		

The qualifications of all personnel performing Special Inspection activities are subject to the approval of the Building Official.

The Special Inspections Administrator and testing agent shall be engaged by the Owner or the Owner's Agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official, prior to commencing work.

The credentials of all inspectors, administrators and testing technicians shall be provided if requested.

It is required that the person administering the Special Inspections program be a Professional Engineer experienced in the design of buildings.

	Key for Minimum Qualifications of Inspection Agents (where indicated on Schedules)
PE	Professional Engineer - a licensed PE specializing in the design of building structures
GE	Geotechnical Engineer - a licensed PE specializing in soil mechanics and foundations
EIT	Engineer in Training with relevant experience
ICC-RCSI	International Code Council (ICC) Certified Reinforced Concrete Special Inspector
ACI-CFTT	American Concrete Institute Certified Concrete Field Testing Technician - Grade 1
ACI-CCI	American Concrete Institute Certified Concrete Construction Inspector
ACI-LTT	American Concrete Institute Certified Laboratory Testing Technician - Grades 1 and 2
ICC-PCSI	International Code Council (ICC) Certified Prestressed Concrete Special Inspector
PTI-L1-UB	Post-Tensioning Institute (PTI) Level 1 Certified Unbonded PT Inspector
PTI-L2-UB	Post-Tensioning Institute (PTI) Level 2 Certified Unbonded PT Inspector
PTI-L1-B	Post-Tensioning Institute (PTI) Level 1 Certified Bonded PT Inspector
PTI-L2-B	Post-Tensioning Institute (PTI) Level 2 Certified Bonded PT Inspector
ICC-SSBSI	International Code Council (ICC) Certified Structural Steel and Bolting Special Inspector
ICC-SWSI	International Code Council (ICC) Certified Structural Welding Special Inspector
AWS-CWI	American Welding Society Certified Welding Inspector
AWS/AISC-SSI	American Welding Society/American Institute of Steel Construction Structural Steel Inspector
ICC-SMSI	International Code Council (ICC) Certified Structural Masonry Special Inspector
ICC-SFSI	International Code Council (ICC) Certified Spray-Applied Fireproofing Special Inspector
EDI-EIFS	Exterior Design Institute - EIFS Level 1 Third Party inspector
AWCI-CEI	Association of the Wall and Ceiling Industry (AWCI) Certified EIFS Inspector
ASNT-L2	American Society of Non-Destructive Testing - Level II
ASNT-L3	American Society of Non-Destructive Testing - Level III
NICET-GETC	National Society for Professional Engineers – Geotechnical Engineering Technology/Construction – Level II (or higher)
ICC-SSI	International Code Council (ICC) Certified Soils Special Inspector
NEBB-CAB	National Environmental Balancing Bureau (NEBB) Certified Air Balancer with expertise in Mechanical and Fire Protection Engineering
AABC-CAB	Associated Air Balance Council (AABC) Certified Test and Balance Engineer (TBE) with expertise in Mechanical and Fire Protection Engineering

Notes:

1. Qualifications of Inspection Agents may be indicated on the Schedule in instances where the Structural Engineer of Record deems such requirements are appropriate.
2. Individual Inspector qualification requirements may be waived at the discretion of the Special Inspections Administrator if the inspections are performed under the supervision of a licensed PE.
3. See Special Inspections Services specification for definition of continuous and periodic inspection frequency.

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Inspection of Fabricators		IBC 1704.2.5			
Verify fabrication/quality control procedures	In-plant review		**Y**	Periodic	1 (PE)
Steel Construction		IBC 1705.2.1			
(References to Steel Construction in this Specification include Structural Steel, Architecturally Exposed Structural Steel, Steel Joist Framing, Metal Fabrications, Metal Stairs and Railings, Decorative Metal Railings, and Cold Formed Metal Framing-CFMF)					
Fabricator and Erector Quality Control Program	In-plant Self evaluation	AISC 360, Chapter N, Section N2.	**Y**		N/A
The fabricator's Quality Control Inspector shall inspect the following as a minimum, as applicable: a. Shop welding, high-strength bolting, and details in accordance with AISC 360 Section N5. b. Shop cut and finished surfaces in accordance in accordance with AISC 360, Section M2. c. Shop heating for straightening, cambering and curving in accordance with AISC 360, Section M2.1. d. Tolerances for shop fabrication in accordance with Code of Standard Practice Section 6.4. The erector's Quality Control Inspector shall inspect the following as a minimum, as applicable: a. Field welding, high-strength bolting, and details in accordance with AISC 360, Section N5. b. Steel deck in accordance with SDI Standard for Quality Control and Quality Assurance for Installation of Steel Deck. c. Headed steel stud anchor placement and attachment in accordance with Section N5.4. d. Field cut surfaces in accordance with AISC 360, Section M2.2. e. Field heating for straightening in accordance with AISC 360, Section M2.1. f. Tolerances for field erection in accordance with Section 7.13 of the Code of Standard Practice.					
Fabricator and Erector Documents	In-plant Self evaluation	AISC 360, Chapter N, Section N3.	**Y**		N/A
Submittals for Steel Construction and Available Documents for Steel Construction shall conform to AISC 360, Section N3.					
Inspection of Fabricators and Fabrication Procedures	In-plant review	IBC 1704.2.5, AISC 360, N6	**Y**		1 (PE)
Inspection of fabricators and fabrication procedures shall be performed by the Quality Assurance Inspector (special inspector) and shall conform to IBC Sections 1704.2.5 and 1704.2.5.1. The requirements of IBC Section 1704.2.5.2 may apply subject to County Approval.					
Inspection and Nondestructive Testing Personnel		AISC 360, Chapter N, Section N4	**Y**		
Quality Control Inspector (fabricator or erector) Qualifications, Quality Assurance Inspector (special inspector) Qualifications and Nondestructive Testing Personnel (inspection agency personnel) Qualifications shall conform to AISC 360, Section N4.					
Welder qualification records and continuity records	Shop and field inspection				
Inspection Tasks Prior to Welding		AISC360 Chapter N, Table N5.4-1			
Welder qualification records and continuity records	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Welding procedure specifications (WPSs) available	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Manufacturer certifications for welding consumables available	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Material identification (type/grade)	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Welder identification system*	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Fit-up of groove welds (including joint geometry) • Joint preparation • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Fit-up of CJP welds of HSS, T-, Y- and K-joints without backing (including joint geometry) • Joint preparations • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location)	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Configuration and finish of access holes	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Fit-up of fillet welds • Dimensions (alignment, gaps and root) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location)	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Check welding equipment	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
* The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.					
Inspection Tasks During Welding		AISC360 Chapter N, **Table N5.4-2**			
Control and handling of welding consumables • Packaging • Exposure control	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
No welding over cracked tack welds	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Environmental conditions • Wind speed within limits • Precipitation and temperature	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
WPS followed • Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type/flow rate • Preheat applied • Interpass temperature maintained (min./max.) • Proper position (F, V, H, OH)	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Welding techniques • Interpass and final cleaning • Each pass within profile limitations • Each pass meets quality requirements	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Placement and installation of steel headed stud anchors	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Inspection Tasks After Welding		AISC360 Chapter N, **Table N5.4-3**			
Welds cleaned	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
Size, length and location of welds	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Welds meet visual acceptance criteria • Crack prohibition • Weld/base-metal fusion • Crater cross section • Weld profiles • Weld size • Undercut • Porosity	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Arc strikes	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
k-area[a]	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Weld access holes in rolled heavy shapes and built-up heavy shapes[b]	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Backing removed and weld tabs removed (if required)	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Repair activities	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
Document acceptance or rejection of welded joint of member	Shop and field inspection		**Y**	Continuous	2 (AWS/ AISC-SSI, AWS-CWI)
No prohibited welds have been added without the approval of the EOR	Shop and field inspection		**Y**	Periodic	2 (AWS/ AISC-SSI, AWS-CWI)
[a]When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks within 3 in. of the weld. [b]After rolled heavy shapes (see Section A3.1c) and built-in heavy shapes (see Section A3.1d) are welded, visually inspect the weld access hole for cracks.					
Inspection Tasks Prior to Bolting		AISC360 Chapter N, **Table N5.6-1**			
Manufacturer's certifications available for fastener materials	Shop and field inspection		**Y**	Continuous	2 (ICC-SSBSI)
Fasteners marked in accordance with ASTM requirements	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Correct bolting procedure selected for joint detail	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and method used	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Protected storage provided for bolts, nuts, washers and other fastener components	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Inspection Tasks During Bolting		AISC360 Chapter N, **Table N5.6-2**			
Fastener assemblies placed in all holes and washers and nuts are positioned as required	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Joint brought to the snug-tight condition prior to the pre-tensioning operation	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Fastener component not turned by the wrench prevented from rotating	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Fasteners are pre-tensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	Shop and field inspection		**Y**	Periodic	2 (ICC-SSBSI)
Inspection Tasks After Bolting		AISC360 Chapter N, **Table N5.6-3**			
Document acceptance or rejection of bolted connections	Shop and field inspection		**Y**	Continuous	2 (ICC-SSBSI)
Nonconforming Materials and Workmanship		AISC360 Chapter N, Section N7	**Y**	Continuous	
Identification and rejection of materials or workmanship that is not in conformance with the construction documents shall not be permitted at any time during the progress of the work. Nonconforming material and workmanship shall be brought to the immediate attention of the General Contractor and the fabricator or erector, as applicable. Nonconforming material or workmanship shall be brought into conformance, or made suitable for its intended purpose as determined by the Structural Engineer of Record. Structural repairs shall be reviewed and approved by the AHJ.					
Cold-formed Steel Deck		IBC 1705.2.2			
1. Material verification of cold-formed steel deck: a. Identification markings to conform to ASTM standards in the approved construction documents. b. Manufacturer's certified test reports.	Field inspection	Applicable ASTM material standards	**Y**	Periodic	2 (ICC-SSBSI)
2. Inspection of welding: a. Cold-formed steel deck: 1) Floor and roof deck welds	Field inspection	AWS D1.3 IBC 1705.2.2	**Y**	Periodic	2 (ICC-SSBSI)
Open Web Steel Joists and Joist Girders		**Table 1705.2.3**			
1. Installation of Open-Web steel joists and joist girders: a. End connections – welded and bolted. b. Bridging – horizontal 1) Standard bridging 2) Bridging that differs from the SJI specifications listed in Section 2207.1			**Y**	Periodic	
2. Bridging that differs from these specifications listed in Section 2207.1			**Y**	Periodic	
Cold-formed steel trusses spanning 60 feet or greater		**IBC 1705.2.4**			
1. Verify temporary and permanent restraint/bracing is installed in accordance with the approved truss submittal package.	Field inspection		**N**	Continuous	2 (EIT, PE, OR ICC-SSBI)

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MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Concrete Construction		**Table 1705.3[a]**			
1. Inspect reinforcement, including prestressing tendons, and verify placement.	Shop and field inspections	IBC 1908.4, ACI 318 Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	**Y**	Periodic	
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum 5/16"; and c. Inspect all other welds.		AWS D1.4 and ACI 318: 26.6.4	**Y**	Periodic	
3. Inspect anchors cast in concrete.		ACI 318: 17.8.2	**Y**	Periodic	
4. Inspect anchors post-installed in hardened concrete members.[b] a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4. a		ACI 318: 17.8.2.4 ACI 318: 17.8.2	**Y**	Continuous Periodic	2 (ACI-CCI, OR ICC-RCSI)
5. Verify use of approved design mix.	Shop and field inspections	ACI 318: Chapter 19 and Sections 26.4.3, 26.4.4 and IBC 1904.1, 1904.2, 1908.2 and 1908.3,	**Y**	Periodic	2 (EIT OR HIGHER)
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	Shop (3) and field inspections (6)	ASTM C172, ASTM C31, ACI 318: 26.5, 26.12	**Y**	Continuous	IBC 1908.10)
7. Inspection of concrete and shotcrete placement for proper application techniques.	Shop (3) and field inspections	ACI 318: 26.5 and IBC 1908.6, 1908.7, 1908.8	**Y**	Continuous	2 (ACI-CCI, OR ICC-RCSI)
8. Verify maintenance of specified curing temperature and techniques.	Shop (3) and field inspections	ACI 318: 26.5.3-26.5.5 and IBC 1908.9	**Y**	Periodic	2 (ACI-CFTT, ACI-LTT,ACI-CCI, OR ICC-RCSI)
9. Inspection of prestressed concrete:					
a. Application of prestressing forces. b. Grouting of bonded prestressing tendons in the seismic-force-resisting system.	Shop (3) and field inspections	ACI 318: 26.1	**N**	Continuous	2 (ICC-PSCSI)
10. Inspect erection of precast concrete members.	Field inspection	ACI 318: 26.9	**N**	Periodic	2 (ICC-PSCSI)
11. Verification of in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to removal of shores and forms from beams and structural slabs.	Review field testing and laboratory reports	ACI 318: 26.11.1.2	**N**	Periodic	2 (ICC-PSCSI)
12. Inspect formwork for shape, location and dimensions of the concrete member being formed.	Field inspection	ACI 318: 26.11.1.2(b)	**Y**	Periodic	2 (EIT OR HIGHER)

[a] Where applicable (for concrete construction), see Section 1705.12, Special Inspections for Seismic Resistance.
[b] Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

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MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Masonry Construction		**IBC 1705.4**			
MASONRY **LEVEL 1** QUALITY ASSURANCE Masonry construction shall be inspected and verified in accordance with TMS 402 **(Table 3.1)** and TMS 602 (**Table 3**) quality assurance program requirements.					
MINIMUM VERIFICATION					
Prior to construction, verify compliance with the approved submittals	Field inspection	TMS 602 Article 1.5	**N**	Periodic	1 (ICC-SMSI or PE)
MASONRY **LEVEL 2** QUALITY ASSURANCE Masonry construction shall be inspected and verified in accordance with TMS 402 (**Table 3.1**) and TMS 602 (**Table 3**) quality assurance program requirements.					
MINIMUM VERIFICATION					
Prior to construction, verify compliance with the approved submittals.	Field inspection	TMS 602 Article 1.5	**Y**	Periodic	1, 2 (ICC-SMSI or PE)
Prior to construction, verification of f'm & f'aac in accordance with TMS 602 Specification Article 1.4 B, except where specifically exempted by TMS 402 Code.	Testing by unit strength method or prism test method	TMS 602 Article 1.4B	**Y**	Periodic	2 (ICC-SMSI)
During construction, verification of slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with TMS 602 Specification Article 1.5 & 1.6.3 for self-consolidating grout.	Field inspection	TMS 602, Article 1.5 & 1.6.3	**Y**	Periodic	1 (ICC-SMSI)
MINIMUM INSPECTION					
1. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of site-prepared mortar.	Field inspection	TMS 602 Article 2.1, 2.6A & 2.6C	**Y**	Periodic	2 (ICC-SMSI)
b. Grade and size of prestressing tendons and anchorages.	Field inspection	TMS 602 Article 2.4B, 2.4H	**N**	Periodic	1, 2 (ICC-SMSI or PE)
c. Grade, type and size of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages.	Field inspection	TMS 602 Article 3.4, 3.6A	**Y**	Periodic	1, 2 (ICC-SMSI or PE)
d. Prestressing technique	Field inspection	TMS 602 Article 3.6B	**N**	Periodic	1, 2 (ICC-SMSI or PE)
e. Properties of thin-bed mortar for AAC masonry.	Field inspection	TMS 602 Article 2.1C.1	**N**	Continuous/ Periodic*	2 (ICC-SMSI)
f. Sample panel construction	Field inspection	TMS 602 Article 1.6D	**Y**	Periodic	1, 2 (ICC-SMSI or PE)
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space.	Field inspection	TMS 602, Article 3.2D, 3.2F	**Y**	Periodic	2 (ICC-SMSI, EIT or Higher)
b. Placement of prestressing tendons and anchorages.	Field inspection	TMS 402 Sec10.8 & 10.9 & TMS 602, Article 2.4, 3.6	**N**	Periodic	2 (ICC-SMSI, EIT or Higher)
c. Placement of reinforcement, connectors, and anchor bolts.	Field inspection	TMS 402 Sec. 6.1, 6.3.1, 6.3.6 & 6.3.7 & TMS 602 Article 3.2E, 3.4	**Y**	Periodic	2 (ICC-SMSI)
d. Proportions of site-prepared grout and prestressing grout for bonded tendons.	Field inspection	TMS 602 Article 2.6B, 2.4G.1.b	**Y**	Periodic	2 (ICC-SMSI)

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PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	TMS 602 Article 1.5	**Y**	Periodic	2 (ICC-SMSI)
b. Placement of masonry units and mortar joint construction	Field inspection	TMS 602 Article 2.3b	**Y**	Periodic	2 (ICC-SMSI)
c. Size and location of structural members.	Field inspection	TMS 602, Article 3.3F	**Y**	Periodic	2 (ICC-SMSI, EIT or Higher)
d. Type, size, and location of anchors, including other details of anchorages of masonry to structural members, frames, or other construction.	Field inspection	TMS 402 Sec. 1.2.1(e), 6.2.1 & 6.3.1	**Y**	Periodic	2 (ICC-SMSI, EIT or Higher)
e. Welding of reinforcement.	Field inspection	TMS 402 Sec. 6.1.6.1.2	**N**	Continuous	2 (ICC-SMSI or AWS-CWI)
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F).	Field inspection	TMS 602 Article 1.8C, 1.8D	**Y**	Periodic	2 (ICC-SMSI)
g. Application and measurement of prestressing force.	Field inspection	TMS 602 Article 3.6B	**N**	Continuous	2 (ICC-SMSI)
h. Placement of grout and prestressing grout for bonded tendons is in compliance.	Field inspection	TMS 602 Article 3.5, 3.6C	**Y**	Continuous	2 (ICC-SMSI, EIT or Higher)
i. Placement of AAC masonry units and construction of thin-bed mortar joints.	Field inspection	TMS 602 Article 3.3B.9 & 3.3F.1.b	**N**	Continuous/ Periodic*	2 (ICC-SMSI, EIT or Higher)
4. Observe preparation of grout specimens, mortar specimens, and/or prisms.	Field inspection	TMS 602 Article 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4	**Y**	Periodic	2 (ICC-SMSI)
* Continuous required for first 5,000 square feet of AAC masonry then Periodic there after					
MASONRY **LEVEL 3** QUALITY ASSURANCE - Masonry construction shall be inspected and verified in accordance with TMS 402 (**Table 3.1.3**) and TMS 602 (**Table 3**) quality assurance program requirements.					
MINIMUM VERIFICATION					
Prior to construction, verify compliance with the approved submittals.	Field inspection	TMS 602 Article 1.5	**N**	Periodic	2 (ICC-SMSI)
Prior to construction, verification of f'm and f'aac in accordance with TMS 602, Specification Article 1.4 B prior to construction and for every 5000 square feet during construction.	Field inspection	TMS 602 Article 1.4B	**N**	Continuous/ Periodic	2 (ICC-SMSI)
Prior to construction, verification of Slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with TMS 602, Specification Article 1.5 & 1.6.3 for self-consolidating grout.	Field inspection	TMS 602 Article 1.4B	**N**	Continuous	2 (ICC-SMSI)
During construction, verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the project site.	Field inspection	TMS 602 Article 1.4B	**N**	Continuous	2 (ICC-SMSI)
MINIMUM INSPECTION					
1. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of site prepared mortar.	Field inspection	TMS 602 Article 2.1, 2.6A, 2.6C	**N**	Periodic	2 (ICC-SMSI)

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PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
b. Grade, type, and size of prestressing tendons and anchorages.	Field inspection	TMS 602 Article 2.4B & 2.4H	**N**	Periodic	2 (ICC-SMSI)
c. Grade, type, and size of reinforcement, connectors, anchor bolts, and prestressing tendons and anchorages.	Field inspection	TMS 602 Article 3.4 & 3.6A	**N**	Periodic	2 (ICC-SMSI)
d. Prestressing technique.	Field inspection	TMS 602 Article 3.6B	**N**	Periodic	2 (ICC-SMSI)
e. Properties of thin-bed mortar for AAC masonry	Field inspection	TMS 602 Article 2.1C.1	**N**	Continuous	2 (ICC-SMSI)
f. Sample panel construction	Field inspection	TMS 602 Article 1.6D	**N**	Continuous	2 (ICC-SMSI)
2. Prior to grouting, verify that the following are in compliance:					
a. Grout space.	Field inspection	TMS 602 Article 3.2D, 3.2F	**N**	Continuous	2 (ICC-SMSI)
b. Placement of grout and prestressing grout for bonded tendons.	Field inspection	TMS 402 Section 10.8 & 10.9 & TMS 602 Article 2.4 & 3.6	**N**	Continuous	2 (ICC-SMSI)
c. Placement of reinforcement, connectors, and anchor bolts	Field inspection	TMS 402 Section 6.1, 6.3.1, 6.3.6, & 6.3.7 & TMS 602 Article 3.2 E & 3.4	**N**	Continuous	2 (ICC-SMSI)
d. Proportions of site-prepared grout and prestressing grout for bonded tendons	Field inspection	TMS 602 Article 2.6B & 2.4 G.1.b	**N**	Periodic	2 (ICC-SMSI)
3. Verify compliance of the following during construction:					
a. Materials and procedures with the approved submittals	Field inspection	TMS 602 Article 1.5	**N**	Periodic	2 (ICC-SMSI)
b. Placement of masonry units and mortar joint construction	Field inspection	TMS 602 Article 3.3 B	**N**	Periodic	2 (ICC-SMSI)
c. Size and location of structural elements.	Field inspection	TMS 602 Article 3.3F	**N**	Periodic	2 (ICC-SMSI)
d. Type, size, and location of anchors including other details of anchorage of masonry to structural members, frames, or other construction.	Field inspection	TMS 402 Sec. 1.2.1(e), 6.2.1 & 6.3.1	**N**	Continuous	2(ICC-SMSI)
e. Welding of reinforcement.	Field inspection	TMS 402 Sec. 6.1.6.1.2	**N**	Continuous	2 (ICC-SMSI)
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40 degrees F) or hot weather (temperature above 90 degrees F).	Field inspection	TMS 602 Article 1.8C, 1.8D	**N**	Periodic	2 (ICC-SMSI)
g. Application of measurement of prestressing force.	Field inspection	TMS 602 Article 3.6B	**N**	Continuous	2 (ICC-SMSI)
h. Placement of grout and prestressing grout for bonded tendons is in compliance.	Field inspection	TMS 602 Article 3.5 & 3.6C	**N**	Continuous	2 (ICC-SMSI)
i. Placement of AAC masonry units and construction of thin-bed mortar joints.	Field inspection	TMS 602 Article 3.3B.9 & 3.3.3F.1.b	**N**	Continuous	2 (ICC-SMSI)
4. Observe preparation of grout specimens, mortar specimens, and/or prisms.	Field inspection	TMS 602 Article 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4	**N**	Continuous	2 (ICC-SMSI)

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MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Wood Construction		**IBC 1705.5**			
1. Inspection of the fabrication process of prefabricated wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review		**N**	Periodic	1,2 (PE)
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans.	Field inspection	IBC 1705.5.1, 2306.2	**N**	Periodic	1,2 (EIT OR HIGHER)
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines and that spacing between fasteners in each line and at edge margins agree with approved building plans.	Field inspection	IBC1705.5.1, 2306.2	**N**	Periodic	1,2 (PE)
Metal-plate-connected wood trusses		**IBC 1705.5.2**			
1, Verify permanent restraint/bracing is installed for wood trusses with overall heights of 60 inches or greater and verify temporary installation restraint/bracing is installed for wood trusses with a clear span of 60 feet or greater in accordance with the approved truss submittal package.	Field inspection		**N**	Continuous	2 (EIT OR HIGHER)
Soils (Earthwork)		**IBC 1705.6**			
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Table 1705.6	**Y**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Table 1705.6	**Y**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
3. Perform classification and testing of compacted fill materials.	Field inspection	Table 1705.6	**Y**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill.	Field inspection	Table 1705.6	**Y**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
5. Prior to placement of compacted fill inspect subgrade and verify that site has been prepared properly.	Field inspection	Table 1705.6	**Y**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
Driven Deep Foundations		**IBC 1705.7**			
1. Verify element materials, sizes and lengths comply with the requirements.	Field inspection	Table 1705.7	**N**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
2. Determine capacities of test elements and conduct additional load tests as required.	Field inspection	Table 1705.7	**N**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
3. Inspect driving operations and maintain complete and accurate records for each element.	Field inspection	Table 1705.7	**N**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	Table 1705.7	**N**	Continuous	3 (GE, NICET-GETC, OR ICC-SSI)
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	Table 1705.7	**N**	See Section 1705.2	See Section 1705.2

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3.	See Section 1705.3	Table 1705.7	**N**	See Section 1705.3	See Section 1705.3
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	Field inspection	Table 1705.7	**N**	In accordance with construction documents	1/3 (GE, NICET-GETC, OR ICC-SSI)
Cast-in-place Deep Foundations		**IBC 1705.8**			
1. Inspect drilling operations and maintain complete and accurate records for each element.	Field inspection	Table 1705.8	**N**	Continuous	2 (EIT OR HIGHER)
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	Field inspection	Table 170568	**N**	Continuous	2 (GE, NICET-GETC, OR ICC-SSI)
3. For concrete elements, perform additional inspections in accordance with Section 1705.3.	See Section 1705.3	Table 1705.8	**N**	See Section 1705.3	2 (See Section 1705.3)
Helical Pile Foundations		**IBC 1705.9**			
1. Verify and record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required.	Field inspection		**N**	Continuous	2 (EIT OR HIGHER)
2. Perform additional inspections and tests in accordance with the construction documents.	Field inspection and testing		**N**	In accordance with construction documents	
Vertical Masonry Foundation Elements		**IBC 1705.4.2**			
1. Perform inspections in accordance with Section 1705.4.	See Section 1705.4		**N**	See Section 1705.4	2 (See Section 1705.4)
Sprayed Fire-Resistant Materials		**IBC 1705.14**			
1. Verify surface condition preparation of structural members is in accordance with approved fire-resistance design and the written instructions of approved manufacturers.	Field inspection	IBC 1705.14.2	**N**	Periodic	2 (ICC-SFSI)
2. Verify application of sprayed fire-resistant materials, including the minimum ambient temperature and ventilation before, during and after application are as specified by the written instructions of approved manufacturers.	Field inspection	IBC 1705.14.3	**N**	Periodic	2 (ICC-SFSI)
3. Verify average thickness of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members.	Field inspection	IBC 1705.14.4	**N**	Periodic	2 (ICC-SFSI)
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design.	Field inspection and testing	IBC 1705.14.5	**N**	Per IBC Section 1704.12.5	2 (ICC-SFSI)
5. Verify the cohesive/adhesive bond strength and condition of the cured sprayed fire-resistant material.	Field inspection and testing	IBC 1705.14.6	**N**	Per IBC Section 1704.12.6	2 (ICC-SFSI)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
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MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Mastic and Intumescent Fire-Resistant Coatings		**IBC 1705.15**			
1. Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks.	Field inspection	AWCI 12-B	**N**	Periodic	2 (ICC-SFSI)
Exterior Insulation and Finish Systems (EIFS)		**IBC 1705.16**			
Inspect all EIFS applications.	Field inspection		**N**	Periodic	2 (EDI-EIFS)
Fire Resistant Penetrations and Joints		**IBC 1705.17**			
Penetration Firestops Inspect & test in accordance with ASTM E2174	Field testing	IBC 1705.17.1/ ASTM E 2174	**N**		2 (ICC-SFSI)
Fire-resistant joint systems test & inspect according to ASTM E2393	Field testing	IBC 1705.17.2/ ASTM E 2393	**N**		2 (ICC-SFSI)
Special Inspection for Smoke Control		**IBC 1705.18**			
1. Perform leakage testing and record device locations during erection and prior to concealment of ductwork.	Field testing		**N**	Periodic	2 (NEBB-CAB or AABC-CAB)
2. Perform pressure difference testing, flow measurements and detection and control verification prior to occupancy and after sufficient completion for the purposes of testing.	Field testing		**N**	Periodic	2 (NEBB-CAB or AABC-CAB)
Structural Wood Special Inspections for Wind Resistance		**IBC 1705.11.1, 1704.6.3**			
1. Inspection during field gluing operations of elements of the main wind force-resisting system.	Field inspection		**N**	Continuous	2 (PE)
2. Inspection of nailing, bolting, anchoring and other fastening of components within main wind force-resisting system, including wood shear walls, wood diaphragms, collectors, drag struts, braces and hold-downs.	Shop and field inspections		**N**	Periodic	2 (PE)
Cold-Formed Steel Light-Frame Construction Special Inspections for Wind Resistance		**IBC 1705.11.2, 1704.6.3**			
1. Inspection during welding operations of elements of the main wind force-resisting system.	Shop and field inspections		**N**	Periodic	2 (ICC-SWSI, AWS-CWI, or AWS/AISC-SSI)
2. Inspection for screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system, including wood shear walls, wood diaphragms, collectors, drag struts, braces and hold-downs.	Shop and field inspections		**N**	Periodic	1, 2 (PE)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Wind Resisting Components Special Inspections for Wind Resistance		**IBC 1705.11.3, 1704.6.3**			
1. Roof cladding.	Shop and field inspections		**N**	Periodic	1, 2 (PE)
2. Wall cladding.	Shop and field inspections		**N**	Periodic	1, 2 (PE)
Structural Steel Special Inspections for Seismic Resistance		**IBC 1705.12.1, 1704.6.2**			
1. Perform inspection of structural steel in accordance with AISC 341.	Shop and field inspections	AISC 341	**N**	In accordance with AISC 341	1, 2 (PE)
Structural Wood Special Inspections for Seismic Resistance		**IBC 1705.12.2, 1704.6.2**			
1. Inspection during field gluing operations of elements of the main seismic-force-resisting system.	Field inspection		**N**	Continuous	1, 2 (PE)
2. Inspection of nailing, bolting, anchoring and other fastening of components within main seismic-force-resisting system, including wood shear walls, wood diaphragms, collectors, drag struts, braces and hold-downs.	Shop and field inspections		**N**	Periodic	1, 2 (PE)
Cold-Formed Steel Light-Frame Construction Special Inspections for Seismic Resistance		**IBC 1705.12.3, 1704.6.2**			
1. Inspection during welding operations of elements of the main seismic-force-resisting system.	Shop and field inspections		**N**	Periodic	2 (ICC-SWSI, AWS-CWI, or AWS/AISC-SSI)
2. Inspection for screw attachment, bolting, anchoring and other fastening of components within the main seismic-force-resisting system, including wood shear walls, wood diaphragms, collectors, drag struts, braces and hold-downs.	Shop and field inspections		**N**	Periodic	1, 2 (PE)
Storage Racks and Access Floors Special Inspections for Seismic Resistance		**IBC 1705.12.7, 1704.6.2**			
1. Inspection during the anchorage of access floors and storage racks 8 feet or greater in height.	Field inspection		**N**	Periodic	1, 2 (PE)
Architectural Components Special Inspections for Seismic Resistance		**IBC 1705.12.5, 1704.6.2**			
1. Inspection during the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneers.	Field inspection		**N**	Periodic	1, 2 (PE)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Mechanical and Electrical Components Special Inspections for Seismic Resistance		**IBC 1705.12.6, 1704.5.2**			
1. Inspection during the anchorage of electrical equipment for emergency and standby power systems in structures assigned to *Seismic Design Category* C, D, E or F.	Field inspection		**N**	Periodic	1, 2 (PE)
2. Inspection during the installation of anchorage of other electrical equipment in structures assigned to *Seismic Design Category* E or F.	Field inspection		**N**	Periodic	1, 2 (PE)
3. Inspection during the installation and anchorage of piping systems intended to carry flammable, combustible or highly toxic contents and their associated mechanical units in structures assigned to *Seismic Design Category* C, D, E or F.	Field inspection		**N**	Periodic	1, 2 (PE)
4. Inspection during the installation and anchorage of HVAC ductwork that will contain hazardous materials in structures assigned to *Seismic Design Category* C, D, E or F.	Field inspection		**N**	Periodic	1, 2 (PE)
5. Inspection during the installation and anchorage of vibration isolation systems in structures assigned to *Seismic Design Category* C, D, E or F where the construction documents require a nominal clearance of ¼ inch or less between the equipment support frame and restraint.	Field inspection		**N**	Periodic	1, 2 (PE)
6. Installation of mechanical and electrical equipment, including ductwork, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to Seismic Design Category C, D, E or F to verify one of the following:					
a. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7. b. A nominal clearance of not less than 3 inches has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection		**N**	Periodic	1, 2 (PE)
Designated Seismic System Verifications Special Inspections for Seismic Resistance		**IBC 1705.13.4, 1704.6.1**			
1. Inspect designated seismic systems requiring seismic qualification in accordance with Section 13.2.2 of ASCE 7 and verify that labels, anchorage or mounting conforms to the certificate of compliance.	Field inspection		**N**	Periodic	1, 2 (PE)
Seismic Isolation System Special Inspections for Seismic Resistance		**IBC 1705.13.8, 1704.6.1**			
1. Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the isolation system.	Shop and field inspections		**N**	Periodic	1, 2 (PE)

SCHEDULE OF SPECIAL INSPECTION SERVICES (IBC 2015)					
PROJECT	Arthur W. Perdue Stadium Improvements				
MATERIAL/ACTIVITY VERIFICATION AND INSPECTION	**SERVICE**	**REFERENCE STANDARD**	**REQ'D (Y/N)**	**FREQUENCY**	**AGENT No. (Qualification)**
Structural Steel Structural Testing for Seismic Resistance		**IBC 1705.13.1, 1704.6.1**			
1. Test in accordance with the quality assurance requirements of AISC 341.	Shop and field inspections	AISC 341	**N**	Per AISC 341	1, 2 (PE)
Seismic Certification of Nonstructural Components		**IBC 1705.14.2, 1704.6.1**			
1. Review certificate of compliance for designated seismic system components.	Certificate of compliance review	ASCE Section 13.2.1	**N**	Each submittal	2 (EIT or HIGHER)
Seismically Isolated Structures		**IBC 1705.14.4, 1704.6.1**			
1. Test seismic isolation structures in accordance with ASCE 7, Section 17.8	Prototype testing	ASCE Section 17.8	**N**	Per ASCE 7	1, 2 (PE)

SECTION 015000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary telecommunications services.

D. Temporary sanitary facilities.

E. Temporary Controls: Barriers, enclosures, and fencing.

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

1.2 TEMPORARY UTILITIES

A. Owner will provide the following:

1. Electrical power and metering, consisting of connection to existing facilities.
2. Water supply, consisting of connection to existing facilities.

B. Existing facilities may be used.

C. New permanent facilities may not be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.3 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
2. Internet Connections: Minimum of one; DSL modem or faster.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is permitted.

C. New permanent facilities may not be used during construction operations.

D. Maintain daily in clean and sanitary condition.

E. At end of construction, return facilities to same or better condition as originally found.

1.5 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide protection for plants designated to remain. Replace damaged plants.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.6 FENCING

A. Construction: Commercial grade chain link fence.

1.7 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.8 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.9 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

F. Existing parking areas located at _____ may be used for construction parking.

G. Provide one parking space for Owner use.

H. Provide one parking space for Architect use.

1.10 WASTE REMOVAL

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

B. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 016000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Agreement.
2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.3 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is required.

1. See Section 011000 for list of items required to be salvaged for reuse and relocation.
2. If reuse of other existing materials or equipment is desired, submit substitution request.

2.2 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 014000 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:

1. Made outside the United States, its territories, Canada, or Mexico.
2. Made using or containing CFC's or HCFC's.
3. Made of wood from newly cut old growth timber.
4. Containing lead, cadmium, or asbestos.

2.3 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.4 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.2 OWNER-SUPPLIED PRODUCTS

A. See Section 011000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.3 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

I. Comply with manufacturer's warranty conditions, if any.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.
2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
2. Identify demolition firm and submit qualifications.
3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.

6. Include in request:
   a. Identification of Project.
   b. Location and description of affected work.
   c. Necessity for cutting or alteration.
   d. Description of proposed work and products to be used.
   e. Alternatives to cutting and patching.
   f. Effect on work of Owner or separate Contractor.
   g. Written permission of affected separate Contractor.
   h. Date and time work will be executed.

E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.3 QUALIFICATIONS

A. For surveying work, employ a professional engineer registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.4 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Perform dewatering activities, as required, for the duration of the project.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

   1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
   2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.5 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.
2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations
2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
2. Remove items indicated on drawings.
3. Relocate items indicated on drawings.
4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. See Section 011000 for other limitations on outages and required notifications.
    c. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:

1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.9 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate with requirements of Section 019113 - General Commissioning Requirements.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify Architect and Owner seven days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.

1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

H. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.

1. Submit to Architect for Owner's review and approval.
2. If Owner wishes to implement any cost alternatives, the Contract Price will be adjusted as specified elsewhere.
3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
4. Describe as many alternatives to landfilling as possible:
    a. List each material proposed to be salvaged, reused, or recycled.
    b. List the proposed local market for each material.
    c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
5. Provide alternatives to landfilling for at least the following materials:
    a. Aluminum and plastic beverage containers.
    b. Corrugated cardboard.
    c. Wood pallets.
    d. Clean dimensional wood.
    e. Land clearing debris, including brush, branches, logs, and stumps.

f. Concrete.
g. Bricks.
h. Concrete masonry units.
i. Asphalt paving.
j. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

C. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
   c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

5. Recycled and Salvaged Materials: Include the following information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:

1. Relative amount of waste produced, compared to specified product.
2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
3. Proposed disposal method for waste product.
4. Markets for recycled waste product.

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PROCEDURES

A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Prebid meeting.
2. Preconstruction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 017800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Materials transparency manual.

D. Warranties and bonds.

1.2 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Materials Transparency Manual:

1. Compile and submit a digital and a printed version of information disclosing materials content for interior finishes, furnishings (including workstations), built-in furniture. Meet IWBI (BS) requirements for format and content.

D. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

1. Include HVAC outdoor and exhaust air damper calibration strategy.
   a. Include provisions which ensure that full closure of dampers can be achieved.
2. Include Carbon Dioxide Monitoring Protocol.
3. Include Carbon Monoxide Monitoring Protocol.
4. Include Frost Mitigation Strategy for ventilation heat-recovery system.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.

d. Field quality control data.

e. Photocopies of warranties and bonds.

4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.6 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

F. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 017900

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

1. All software-operated systems.
2. HVAC systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Conveying systems.
6. Landscape irrigation.
7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:

1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
2. Finishes, including flooring, wall finishes, ceiling finishes.
3. Fixtures and fittings.
4. Items specified in individual product Sections.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
2. Submit one copy to the Commissioning Authority, not to be returned.
3. Make commissioning submittals on time schedule specified by Commissioning Authority.
4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Architect for transmittal to Owner.
2. Submit to Commissioning Authority for review and inclusion in overall training plan.
3. Submit not less than four weeks prior to start of training.
4. Revise and resubmit until acceptable.
5. Provide an overall schedule showing all training sessions.
6. Include at least the following for each training session:
   a. Identification, date, time, and duration.
   b. Description of products and/or systems to be covered.
   c. Name of firm and person conducting training; include qualifications.

d. Intended audience, such as job description.
e. Objectives of training and suggested methods of ensuring adequate training.
f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
g. Media to be used, such a slides, hand-outs, etc.
h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:

1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 018113

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain International Green Construction Code powered by ASHRAE 189.1 (IgCC/ASHRAE 189.1) requirements.

1. Other IgCC/ASHRAE 1891 requirements depend on product selections and may not be specifically identified as IgCC/ASHRAE 189.1 requirements. Compliance with IgCC/ASHRAE 189.1 requirements will be used as one criterion to evaluate substitution requests and comparable product requests.
2. Specific IgCC/ASHRAE 189.1 requirements are also included in other Sections.

1.3 DEFINITIONS

A. IgCC/ASHRAE 189.1: International Green Construction Code powered by ASHRAE 189.1.

1. Definitions that are a part of the IgCC/ASHRAE 189.1 apply to this Section.

B. Recycled Content: Building product recycled content is determined as postconsumer content plus one half preconsumer recycled content, based on weight. The recycled fraction is then multiplied by the cost of the product or assembly.

C. Salvaged Material Content: Building product salvaged content is determined by the actual cost of the salvaged material or the cost of a comparable alternative component material.

D. Recyclable Building Materials and Building Components: Materials and components that can be recycled into the same or another material with a recovery rate of not less than 50 percent or that are recyclable through an established, nationally available, closed-loop manufacturer's take-back program.

E. Bio-Based Materials: Building products that meet one of the following requirements:

1. Materials that comply with the minimum biobased contents of the USDA's BioPreferred Program.
2. Materials that contain the USDA-certified Biobased Product label.
3. Materials composed of solid wood, engineered wood, bamboo, wool, cotton, cork, agricultural fibers, or other biobased materials with at least 50% bio-based content.
4. Wood and wood products that contain not less than 60% wood content tracked by a chain-of-custody process and documented and certified in accordance with principles, standards, and criteria developed using ISO/IEC Guide 59 or the WTO Agreement on Technical Barriers to

Trade.

F. Regional Materials: Building materials that are composed of materials and products that are manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If materials are transported by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to the Project site. If only a portion of a material or product complies with this requirement, only that portion contributes to regional compliance.

G. Multiple-Attribute Product Declaration or Certification: A minimum of 10 different products installed in the Project comply with one of the following:

1. Type III Industry-Wide Environmental Product Declaration consistent with ISO 14025 and ISO 21930 and minimum cradle-to-gate scope.
2. Type III Product-Specific Environmental Product Declaration complying with the goal and scope for the cradle-to-gate requirements in accordance with ISO 14025 and ISO 21930.
3. Material-Specific Third-Party Multi-Attribute Certification in Accordance with One of the Following Standards:

a. NSF/BIFMA E3.
b. NSF/ANSI 140.
c. NSF/ANSI 332.
d. NSF/ANSI 336.
e. NSF/ANSI 342.
f. NSF/ANSI 347.
g. NSC/ANSI 373.
h. ANSI A138.1.
i. UL 100.
j. UL 102.

4. Third-party critical review of product life-cycle assessment in compliance with ISO 14040 and ISO 14044.

H. Performance Option: Perform life-cycle assessment in accordance with ASTM E2921 and ISO 14044.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review IgCC/ASHRAE 189.1 requirements and action plans for meeting requirements.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect regarding IgCC/ASHRAE 189.1 requirements that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures. Document responses as informational submittals.

1.6 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

B. Sustainable design submittals are in addition to other submittals.

1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated IgCC/ASHRAE 189.1 requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

C. IgCC/ASHRAE 189.1 Documentation Submittals:

1. Material Selection: Product Data for salvaged, recycled, recyclable, bio-based, and regional materials showing compliance with requirements. Tabulate cost for building materials used in the Project and indicate those that are salvaged, recycled, recyclable, bio-based, or regional. Include summary of building materials tabulation, showing compliance with requirement and the following:

a. Receipts for salvaged materials, indicating sources and mass, volume, or cost as applicable.
b. Product Data and certification letter from product manufacturers for recyclable materials. Include statement indicating cost.
c. Product Data and certification letter from product manufacturers indicating percentage by weight of recycled content for products having recycled content. Include statement indicating cost.
d. Product Data and certification letter from product manufacturers for bio-based materials. Include chain-of-custody certificates for products containing certified wood. Include statement indicating cost.
e. Product Data for indigenous materials indicating location of material manufacturer and point of extraction, harvest, or recovery for raw materials. Include statement indicating distances from Project site, modes of transportation, and cost.

2. Construction Waste Management: Comply with Section 017419 "Construction Waste Management and Disposal."
3. Indoor-Air Quality (IAQ) During Construction:

a. Construction IAQ management plan.
b. Product Data for temporary filtration media.
c. Product Data for filtration media used during occupancy.

4. Material Emissions and Pollutant Control: Product Data for the following, indicating compliance with requirements:

a. Composite wood products.
b. Adhesives and sealants.
c. Paints and coatings.
d. Flooring and accessories.
e. Acoustical ceilings and wall systems.
f. Insulation.

1.7 INFORMATIONAL SUBMITTALS

A. Action Plans: Submit the following action plans within 14 days of date established for commencement of the Work, indicating how requirements will be met.

1. Material Selection Plan: List of proposed materials. Tabulate anticipated mass, volume, or cost for proposed building materials and indicate those that are used, recycled, recyclable, bio-based, or indigenous. Include summary of proposed building materials tabulation, showing compliance with requirement.
2. Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
3. Material Emissions and Pollutant Control Plan: List of proposed products. Indicate each product that complies with criteria, each product that does not, and anticipated quantities of each that will be used. Include calculations showing that percentage of noncompliant products will not exceed allowable limit.
4. Construction IAQ management plan.
5. Green Building Cleaning Plan: Provide cleaning plan compliant with Green Seal Standard GS-42.
6. Site Sustainability Operation Plan: Provide maintenance of plantings and cleaning of the TPO roof surfaces.
7. Building Operation Maintenance Plan: Develop a maintenance plan for mechanical, electrical, plumbing and fire protection systems.
    a. Plan shall be in accordance with ANSI/ASHRAE/ACCE Standard 180 for HVAC systems commercial buildings.
    b. Visual inspection of all outdoor air delivery monitors shall be done at least once a quarter with calibration as recommended by the manufacturer.
    c. Any system with a damper indicator shall be visually inspected every two years.
    d. Documentation of the plan and completed maintenance procedures shall be maintained on site at all times and include maintenance manuals and completed maintenance activities.

B. Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction activities with action plans.

C. Acoustical Testing: Provide the following acoustical testing to verify compliance with IgCC.

1. Interior Background Sound Levels
2. Interior Sound Transmission
3. Property Line Sound Levels

D. Envelope Airtightness Testing: Provide testing in compliance with ANSI/ASHRAE/IES Standard 90.1 with the following modifications/additions as required in Fluid-Applied Membrane Air Barriers, Section 072726.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to comply with requirements in this Section for material selection and for material emissions and pollutant control. Although other Sections may specify some requirements for material selection and for material emissions and pollutant control, the Contractor provides additional materials and procedures necessary to comply with requirements.

B. Wood Products: A minimum of 25% of wood-based products and materials permanently installed in the building's interior must be certified in accordance with the Forest Stewardship Council's

criteria or approved equivalent as calculated by material cost. Components may include general dimensional framing, flooring, subflooring, wood doors and finishes.

C. Recycled Content: 45% of the total volume of the materials cost in the Project must be comprised of materials that have pre-consumer and/or post-consumer recycled content, based on cost. Products in divisions 03-10, 31 (31 60 00 Foundations), 32 (32 10 00 Paving, 32 30 00 Site Improvements and 32 90 00 Plantings) from CSI Masterformat, current edition, are subject to this requirement and comply with IgCC 901.4.1.

D. Regional Materials: 20% the total value of the material costs in the Project must be comprised of materials that have been extracted, harvested or recovered, and manufactured within 500 miles of the Project site, based on cost. Products in divisions 03-10, 31 (31 60 00 Foundations), 32 (32 10 00 Paving, 32 30 00 Site Improvements and 32 90 00 Plantings) from CSI Masterformat, current edition, are subject to this requirement.

2.2 SITE

A. Site Hardscaping: Provide site hardscaping with a minimum Solar Reflectance Index (SRI) of 29. Final concrete colorant selected must also comply with this requirement.

B. Composite Wood Products: No products used inside the weatherproofing system shall contain urea-formaldehyde resin. Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde. Added urea-formaldehyde may not be present in any laminating adhesives used in composite wood assemblies.

2.3 MATERIAL EMISSIONS AND POLLUTANT CONTROL

A. Composite Wood Products: Formaldehyde emission rates not greater than the following when tested according to ASTM D6007 or ASTM E1333.

1. Hardwood Plywood: 0.05 ppm.
2. Particleboard: 0.09 ppm.
3. Medium-Density Fiberboard More Than 5/16 Inch Thick: 0.11 ppm.
4. Medium-Density Fiberboard 5/16 Inch or Less in Thickness: 0.13 ppm.

B. Adhesives and Sealants Inside the Weatherproofing System: Comply with either of first two subparagraphs below:

1. Comply with VOC emissions requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Do not exceed formaldehyde emissions of 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.
   a. Low-Emitting Materials – Adhesives and Sealants: All adhesives and sealants used inside of the weatherproofing system and applied on site must comply with the General Emissions Evaluation and VOC content requirements for wet applied products. Additionally, exterior applied products including adhesives, sealants, coatings, roofing and waterproofing materials applied onsite must meet the VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule 1168, effective July 1, 2005. Small containers of adhesives and

sealants subject to state or federal consumer product VOC regulations are exempt.
This strategy correlates to LEED Credit: Low-Emitting Materials.

2. Do not exceed VOC content limits of authorities having jurisdiction and the following:

   a. Carpet Adhesives: 50 g/L.
   b. Carpet Pad Adhesives: 50 g/L.
   c. Wood Flooring Adhesive: 100 g/L.
   d. Rubber Floor Adhesives: 60 g/L.
   e. Subfloor Adhesives: 50 g/L.
   f. Ceramic Tile Adhesives: 65 g/L.
   g. VCT and Asphalt Tile Adhesives: 50 g/L.
   h. Gypsum Board and Panel Adhesives: 50 g/L.
   i. Cove Base Adhesives: 50 g/L.
   j. Multipurpose Construction Adhesives: 70 g/L.
   k. Structural Glazing Adhesives: 100 g/L.
   l. Single-Ply Roof Membrane Adhesive: 250 g/L.
   m. Architectural Sealants: 250 g/L.
   n. Sealant Primers for Nonporous Substrates: 250 g/L.
   o. Sealant Primers for Porous Substrates: 775 g/L.
   p. Modified Bituminous Sealant Primers: 500 g/L.
   q. Other Sealant Primers: 750 g/L.
   r. CPVC Welding Compounds: 490 g/L.
   s. PVC Welding Compounds: 510 g/L.
   t. ABS Welding Compounds: 325 g/L.
   u. Plastic Cement Welding Compounds: 250 g/L.
   v. Adhesive Primer for Plastic: 550 g/L.
   w. Contact Adhesive: 80 g/L.
   x. Special-Purpose Contact Adhesives (Contact Adhesives That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
   y. Structural Wood Member Adhesives: 140 g/L.

C. Field Paints and Coatings Inside the Weatherproofing System: Comply with either of the following for VOC emissions:

   1. The requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.
      a. Low-Emitting Materials – Paints and Coatings: All paints and coatings applied on site and used inside of the weatherproofing system and applied on site must comply with the General Emissions Evaluation and VOC content requirements for wet applied products. Additionally, exterior applied products including adhesives,sealants, coatings, roofing and waterproofing materials applied onsite must meet the VOC limits of California Air Resources Board (CARB) 2007 Suggested Control Measure for Architectural Coatings, and South Coast Air Quality Management District (SCAQMD), Rule 1168, effective July 1, 2005. Small containers of adhesives and sealants subject to state or federal consumer product VOC regulations are exempt. This strategy correlates to LEED Credit: Low-Emitting Materials.

   2. Do not exceed VOC content limits of authorities having jurisdiction and the following:

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Nonflat - High Gloss Coatings: 150 g/L.
d. Basement Special Coatings: 400 g/L.
e. Bond Breakers: 350 g/L.
f. Concrete Curing Compounds: 350 g/L.
g. Concrete/Masonry Sealers: 100 g/L.
h. Dry-Fog Coatings: 150 g/L.
. Faux Finishing Coatings: 350 g/L.
j. Fire-Resistive Coatings: 350 g/L.
k. Floor Coatings: 100 g/L.
l. Form-Release Compounds: 250 g/L.
m. Graphic Arts Coatings (Sign Paints): 500 g/L.
n. High-Temperature Coatings: 420 g/L.
o. Industrial Maintenance Coatings: 250 g/L.
p. Low-Solids Coatings: 120 g/L.
q. Magnesite Cement Coatings: 450 g/L.
r. Mastic Texture Coatings: 100 g/L.
s. Metallic Pigmented Coatings: 500 g/L.
t. Multicolor Coatings: 250 g/L.
u. Pretreatment Wash Primers: 420 g/L.
. Primers, Sealers, and Undercoaters: 100 g/L.
w. Reactive Penetrating Sealers: 350 g/L.
. Recycled Coatings: 250 g/L.
y. Rust-Preventive Coatings: 250 g/L.
z. Shellacs, Clear: 730 g/L.

aa. Shellacs, Pigmented: 550 g/L.
bb. Stains: 250 g/L.
cc. Swimming Pool Coatings: 340 g/L.
dd. Tub and Tile Refinish Coatings: 420 g/L.
ee. Waterproof Membranes: 250 g/L.
ff. Wood Coatings: 275 g/L.
gg. Wood Preservatives: 350 g/L.
hh. Zinc-Rich Primers: 340 g/L.

D. Flooring: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less. Where postmanufactured coatings or applications have not been applied, concrete, ceramic and concrete tile, clay and concrete pavers, metal, and organic-free, mineral-based flooring complies with this requirement.

E. Acoustical Ceilings: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less.

F. Wall Systems: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less. Where postmanufactured coatings or applications have not been applied, concrete, concrete masonry, clay masonry, gypsum plaster, ceramic and concrete tile, metal, and organic-free, mineral-based materials comply with this requirement.

G. Insulation: Comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 micrograms/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 017419 "Construction Waste Management and Disposal."

B. Divert a minimum of 90% of nonhazardous construction and demolition waste material generated prior to the issuance of the final certificate of occupancy. Waste shall be diverted from disposal in landfills and incinerators by reuse, recycling, repurposing and/or composting. Excavated soil and land-clearing debris is not included in the diversion calculation.

3.3 CONSTRUCTION IAQ MANAGEMENT

A. Construction related vehicles on the construction site shall not idle for more than 5 minutes in any 60-minute period except where necessary to perform construction related functions. Contractor shall post signs at the vehicle entrance/ street loading zone providing notice of the requirement.

B. Cover or close openings in ducts and other related air-distribution component openings with tape, plastic, sheet metal, or other approved method before beginning dust-producing operations, and maintain until dust-producing operations are complete.

C. Building will be occupied during construction and additional measures to prevent construction activity pollution/ contaminant entry will be required. Coordinate with owner to secure operable windows, doors and air intake openings serving owner occupied spaces within 35 feet of the limits of construction.

D. Implement measures to control moisture during construction. Materials stored on-site or installed that are absorptive must be protected from moisture damage. Any material that shows evidence of biological growth due to the presence of moisture shall not be installed on the building site. Any materials that are installed that show biological growth will be removed and replaced.

E. Provide temporary ventilation during construction, using one or more of the following methods:

1. Natural ventilation complying with the IBC.
2. Fans that produce three air changes per hour.
3. Exhaust in work areas at not less than 0.05 cfm/sq. ft. and not less than 10 percent greater than supply air to maintain a negative pressure.

F. Air-Quality Testing: Engage testing agency to perform the following:

1. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols in accordance with ASTM D5197and USEPA Compendium of Methods for the Determination of Toxic Organic Pollutants in Ambient Air, TO-1, TO-11 and TO-17. A minimum of one sampling point per 25,000 sq. ft. or each contiguous floor area is required.
2. Concentrations of the following shall not exceed the following:

    a. Particulates (PM2.5): 35 micrograms/cu. m. (24 h)
    b. Particulates (PM10): 150 micrograms/cu. m. (24 h)
    c. Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
    d. 1, 1, 1-Trichloroethane: 1000 micrograms/cu. m.
    e. 1, 3-Butadiene: 20 micrograms/cu. m.
    f. 1, 4-Dichlorobenzene: 800 micrograms/cu. m.
    g. 1, 4-Dioxane: 3000 micrograms/cu. m.
    h. 2-Propanol: 7000 micrograms/cu. m.
    i. Acetaldhyde: 140 micrograms/cu. m.
    j. Acrylonitrile: 5 micrograms/cu. m.
    k. Benzene: 60 micrograms/cu. m.
    l. t-Butyl Methyl Ether: 8000 micrograms/cu. m.
    m. Carbon Disulfide: 800 micrograms/cu. m.
    n. Carbon Tetrachloride: 40 micrograms/cu. m.
    o. Chlorobenzene: 1000 micrograms/cu. m.
    p. Chloroform: 300 micrograms/cu. m.
    q. Dichloromethene: 400 micrograms/cu. m.
    r. Ethybenzene: 2000 micrograms/cu. m.
    s. Ethylene Glycol: 400 micrograms/cu. m.
    t. Formaldehyde: 33 micrograms/cu. m.
    u. n-Hexane: 7000 micrograms/cu. m.
    v. Naphthalene: 9 micrograms/cu. m.
    w. Phenol: 200 micrograms/cu. m.
    x. Styrene: 900 micrograms/cu. m.
    y. Tetrachloroethane: 35 micrograms/cu. m.
    z. Toluene: 300 micrograms/cu. m.
    aa. Trichloroethane: 600 micrograms/cu. m.
    bb. Xylene Isomers: 700 micrograms/cu. m.
    cc. Total Volatile Organic Compounds: 500 micrograms/cu. m.

3. Where carpets and fabrics with styrene butadiene rubber latex backing are installed, the following are the maximum allowable concentrations:

    a. 1-Methyl-2-Pyrrolidinone: 160 micrograms/cu. m.
    b. 2-Ethylhexanoic Acid: 25 micrograms/cu. m.
    c. 4-Phenylcyclohexene (4-PH): 2.5 micrograms/cu. m.
    d. Caprolactam: 100 micrograms/cu. m.
    e. Nonanal: 13 micrograms/cu. m.
    f. Octanal: 7.2 micrograms/cu. m.

4. The testing must demonstrate that the contaminant maximums listed are not exceeded in the return airstreams of the HVAC systems that serve the space. If the return airstream cannot be separated from other spaces, test each space served by a separate system. If any maximum concentration limit is exceeded and not mitigated and successfully retested, the building shall be flushed out for 14 days with air-handling units at maximum outside air

while maintaining a temperature of at least 60 deg F and a relative humidity of not more than 60 percent. Repeat the procedure twice. When retesting non-compliant building areas,take samples from the same locations as the first test.

END OF SECTION

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.

2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.

3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.

4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner.

1.2 RELATED REQUIREMENTS

A. Section 01 78 23 – Operation and Maintenance Data: Scope and procedures for operation and maintenance manuals and project record documents.

1.3 REFERENCE STANDARDS

A. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm.

1.4 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.

2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in

preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2003 preferred.

5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

C. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.
2. Manufacturer's installation instructions.
3. Startup, operating, and troubleshooting procedures.
4. Fan and pump curves.
5. Factory test reports.
6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 – PRODUCTS – Not Used

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing of equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5-degree F and resolution of plus/minus 0.1 degree F.
2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.

1. Dataloggers required to for Functional Tests will be provided by the Commissioning

Authority and will not become the property of Owner.

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:

1. Startup Plan: SP-.

2. Startup Report: SR-.

3. Prefunctional Checklist: PC-.

4. Functional Test Procedure: FTP-.

5. Functional Test Report: FTR-.

C. System Type: Use the first 4 digits from CSI/CSC MasterFormat, current edition, that are applicable to the system; for example:

1. 2300: HVAC system as a whole.

2. 2320: HVAC Piping and Pumps.

3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC

piping system, probably a pump; this is the second, revised submittal of this checklist.

3.3 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.4 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.

b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

d. Serial number of installed unit.

e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.

f. Sensor and actuator calibration information.

4. Some preliminary Prefunctional Checklists are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.

5. Samples of Prefunctional Checklist forms that indicate anticipated level of detail can be found at http://www.peci.org/library/mcpgs.htm.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing;

re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at his option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.

1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.5 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.

2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.

5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.

2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.

d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

3. Some preliminary Functional Test procedures are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.

4. Samples of Functional Test forms that indicate anticipated level of detail can be found at http://www.peci.org/library/mcpgs.htm.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.

H. Field Tests by Others: Where Functional Tests are indicated as to be performed by others not subject

to the Contract Documents, those tests are not subject to these commissioning requirements.

3.6 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gages, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2-degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors with Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gage or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.

12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Barometric Pressure: 0.1 inch of Hg (.
7. Flow Rate, Air: 10 percent of design.
8. Flow Rate, Water: 4 percent of design.
9. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.7 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor

size or capacity difference.

2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example, apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems, where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least

5 columns of point values on same page.

5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.8 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

SECTION 019114

COMMISSIONING AUTHORITY RESPONSIBILITY

PART 1 - GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.
2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications
and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

D. The Commissioning Authority is to be employed by Owner.

1.2 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process

B. PECI (MCP) - Model Commissioning Plan; Portland Energy Conservation, Inc.; located at http://www.peci.org/library/mcpgs.htm.

1.3 SUBMITTALS

A. Commissioning Plan:

1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
2. Submit revised draft to be included in the construction contract documents, not less than 4 weeks prior to bid date.

3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:

1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:

1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. List of Functional Test procedures to be developed:

1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the Contract Documents; this is intended to be a list of titles, not full description of the tests.
3. Submit final list not more than 60 days after start of construction.

E. Functional Test Procedures:

1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

F. Training Plan.

G. Commissioning Record: Submit to Contractor for inclusion with O&M manuals.

H. Final Commissioning Report: Submit to Owner.

I. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 COMMISSIONING PLAN

A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.

1. Call and chair meetings of the Commissioning Team when appropriate.
2. Give Contractor sufficient notice for scheduling commissioning activities.
3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
4. The PECI Model Commissioning Plan may be used as a guide for the Commissioning Plan.
5. ASHRAE Guideline 1 may be used as a guide for the Commissioning Plan.
6. Avoid replication of information included in the construction contract documents to the greatest extent possible.

B. Review the construction contract documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:

1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
2. Contractor's scheduling responsibilities are specified in the construction contract documents.
3. Revise and re-issue schedule monthly.
4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

D. Commissioning Team: Project manager or another designated person of:

1. Owner's building or plant operation staff.
2. Commissioning Authority.
3. Construction Manager.
4. Design professional's design team.
5. General Contractor.
6. HVAC contractor.
7. HVAC control system subcontractor.
8. HVAC testing, adjusting, and balancing (TAB) subcontractor.
9. Electrical contractor.
10. Plumbing contractor.
11. Communications contractor.

3.2 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction contract documents; review and submit comments to Owner.

1. These specifications include:

a. Procedures applicable to all types of items to be commissioned.

2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Architect:

a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.

b. Additional Owner personnel training.

c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.

1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.

2. The Checklist forms are intended to be part of the Contractor's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned.

1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.

2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction contract documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction contract documents

3.3 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.

1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.

2. Identify each Checklist by using the contract documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.

3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.

4. Include space to record manufacturer name, model number, serial number, capacity and other

relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.

5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
6. Include line items for each physical inspection to be performed.
7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:

1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
   a. "This Checklist is submitted for approval with no exceptions."
   b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

3.4 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm- up, cool-down, part- and full-load.

1. Obtain assistance and review by installing subcontractors.
2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
3. Include test setup instructions, description of tools and apparatus, special cautions, and.
4. Avoid procedures that would void or otherwise limit warranties, review with Contractor prior to execution.

5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
6. Obtain explicit approval of Contractor regarding feasibility and safety prior to execution.

B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Contractor and:

1. Report Identifier (see Documentation Identification Scheme).
2. Test prerequisites.
3. Formulas to be used in calculations.
4. Yes/No check boxes for each step of test.
5. Space to record results, document deficiencies, and make recommendations.
6. Signature and date block for Commissioning Authority.

C. Functional Test Prerequisites: Include space to verify all the following items on each Functional Test Report Form, unless truly inapplicable:

1. All related equipment has been started up and start-up reports and Prefunctional Checklists submitted and approved ready for Functional Testing.
    a. For hydronic systems, check that:
        1) Piping system flushing is complete and required report approved.
        2) Water treatment system is complete and operational.
        3) Test and balance (TAB) are complete and approved.
2. All control system functions for this and all interlocking systems are programmed and operable in accordance with the Contract Documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed, with space for signature of controls installer.
3. Incomplete items identified by Architect during closeout inspections have been corrected or completed.
4. Safeties and operating ranges have been reviewed.
5. A copy of the specified sequence of operation is attached.
6. A copy of applicable schedules and setpoints is attached.
7. A copy of the specified Functional Test Procedures is attached.
8. The Functional Test Procedures have been reviewed and approved by the applicable installer.
9. Vibration control report approved (if required).
10. False loading equipment, system and procedures ready.
11. Sufficient clearance around equipment for servicing.
12. Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, with a check box provided to verify return to original values (include control parameters, limits, delays, lockouts, schedules, etc.).

13. Any other items on the Prefunctional Checklist or Start-up Reports that need to be re- verified.

3.5 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager, ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.

E. Submit periodic progress reports to Owner and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:

1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.

2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.

3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.

4. Review TAB Plan prepared by Contractor.

5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.

6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.

7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer's personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

O. Perform Functional Testing for systems and equipment so specified, without assistance of Contractor.

P. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

Q. O&M Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

R. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

3.6 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.

1. Include a minimum 4 hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.

2. Include a minimum 4 hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test report forms for re-commissioning purposes.

3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

3.7 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.

1. Include the Final Commissioning Plan and Final Report.

2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:

a. Design intent documentation, furnished by Architect or others.

b. Detailed operational sequences.

c. Startup plan and approved startup reports.

d. Filled out Prefunctional Checklists.

e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.

f. Training plan and training records.

g. Recommissioning recommendations, including time schedule and procedures; include blank

copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:

1. Executive summary.
2. List of participants and roles.
3. Brief facility description.
4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
   a. The product itself, i.e. compliance with the contract documents.
   b. Installation.
   c. Functional performance: include a brief description of the verification method used and observations and conclusions from the testing.
   d. O&M documentation, including design intent.
   e. Operator training.
6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

3.8 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Owner's staff.

1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
3. Make suggestions for improvements and for recording these changes in the O&M manuals.
4. Identify areas of concern that are still under warranty or are the responsibility of the original

construction contractor.

5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION

SECTION 023200

GEOTECHNICAL INVESTIGATION

Refer to the following Geotechnical Report dated April 12, 2024, prepared by Geo-Technology Associates, Inc. for information concerning subsoil investigation and geotechnical recommendations.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing Geoprofessional Business Association Member Firm

April 12, 2024
Revised June 19, 2024

McCrone Engineering
119 Naylor Mill Road, Suite 3
Salisbury, Maryland 21801

Attn: Mr. Ryan Conway, P.E.
Project Manager

Re: Report of Subsurface Exploration
Arthur W. Perdue Stadium Upgrades
Salisbury, Wicomico County, Maryland

Ladies & Gentlemen:

Pursuant to your request, Geo-Technology Associates, Incorporated (GTA) has performed geotechnical exploration at the proposed ***Arthur W. Perdue Stadium Upgrades*** project located in the Salisbury area of Wicomico County, Maryland. The purpose of the subsurface exploration was to present our recommendations with respect to foundation and slab support for the proposed prefabricated metal building/batting tunnels, earthwork, and utility construction and retaining wall design parameters. Preliminary recommendations and conclusions regarding seasonal high groundwater levels, infiltration feasibility and SWM facility construction will also be presented. The exploration consisted of performing ten SPT borings within the area of the proposed improvements, visually classifying the soils, and performing limited laboratory testing.

Unless McCrone Engineering specifies otherwise, the samples collected as a part of the subsurface exploration will be disposed of after a period of 60 days from the date of this report. Thank you for the opportunity to be of assistance. If you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,
GEO-TECHNOLOGY ASSOCIATES, INC.

STATE OF MARYLAND
GREGORY ROBERT SAUTER
NO. 19923
REGISTERED
PROFESSIONAL ENGINEER

Travis P. Caraway, P.E.
Associate

Gregory R. Sauter, P.E.
Vice President

TPC/GRS/llh 31240250

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland. License No.: 19923, Expiration Date: 01/20/2025. GS

REPORT OF SUBSURFACE EXPLORATION

Arthur W. Perdue Stadium Upgrades

Batting Tunnels, Bullpen Retaining Wall Parameters and Stormwater Management Facilities

Salisbury
Wicomico County, Maryland

April 12, 2024
Revised June 19, 2024

Prepared For:

McCrone Engineering
119 Naylor Mill Road, Suite 3
Salisbury, Maryland 21801

Attn: Mr. Ryan Conway, P.E.
Project Manager

Prepared By:

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
21491 Baltimore Avenue, Unit 1
Georgetown, Delaware 19947
302-855-9761

GTA Job No: 31240250

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GBA—Important Information About Your Geotechnical Engineering Report

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Appendix A – Figures
- Figure No. 1, Site Location Plan
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REPORT OF SUBSURFACE EXPLORATION
ARTHUR W. PERDUE STADIUM UPGRADES
BATTING TUNNELS, BULLPEN RETAINING WALL PARAMETERS
AND STORMWATER MANAGEMENT FACILITIES
WICOMICO COUNTY, MARYLAND
APRIL 2024
REVISED JUNE 2024

INTRODUCTION

New improvements including a prefabricated metal building for batting tunnels and two retaining walls for the new bullpens are proposed at Arthur W. Perdue Stadium in the Salisbury area of Wicomico County, Maryland. Geo-Technology Associates, Inc. (GTA) was retained by McCrone Engineering to perform a geotechnical exploration of the site. The scope of this study included field exploration, laboratory analysis, and preliminary recommendations with respect to foundation and slab support for the proposed prefab metal building/batting tunnel, earthwork, and utility construction and retaining wall design parameters. Preliminary recommendations and conclusions regarding seasonal high groundwater levels, infiltration feasibility and SWM facility construction will also be presented. The field exploration consisted of ten Standard Penetration Test (SPT) borings performed within the proposed improvement areas. A layout sketch titled *Shorebirds Stadium Boring Layout Sketch* prepared by McCrone Engineering and dated February 26, 2024, and site plans titled *Arthur W. Perdue Stadium* prepared by Ewing Cole and dated June 7, 2024, were referenced for this report.

SITE CONDITIONS

Referring to the Site Location Map and the Exploration Location Plan included as Figures 1 and 2, respectively, in Appendix A, the complex is situated within an irregular shaped, approximately 38-acre, parcel located on the northwest side of Hobbs Road, south of Ocean Gateway (Route 50) in the Salisbury area of Wicomico County, Maryland. DE-Chem, LLC and Salisbury Baptist Temple border the site to the east and south and grasslands border the site to the west. The stadium is the Home of the Delmarva Shorebirds, a minor league baseball team. The facility includes the baseball field, stands with a capacity of approximately 5,000 seats, press box, associated parking lots, drive lanes and various other related infrastructure. The study areas are located off the field along the first and third base lines, just beyond the bullpen/warmup areas.

Additionally, the subject area includes the grass covered areas outside the stadium on the south side of the northern entrance driveway (Entrance A). The ground surface at the exploration locations ranges between approximate Elevation 52 and 63 Mean Sea Level (MSL).

PROPOSED CONSTRUCTION

The proposed upgrades will consist of a new pre-fabricated metal building that will primarily be used for the batting/pitching tunnels. The building will have a footprint on the order of 9,000 square feet and have a finished floor at approximate Elevation 56.75 MSL. GTA understands that the building foundations loads will be on the order of 6.5 kips per lineal foot for the wall loads and upwards to 60 kips for column loads. GTA understands that the existing concrete concourse area will be removed to facilitate the construction of proposed batting tunnel.

Also, two new retaining walls are proposed to move/expand the home and away bullpens away from the playing field at approximate Elevation 49 to 50 MSL. The retaining walls are proposed to be precast concrete walls. Pre-engineered metal canopies will also be constructed in the bullpen areas. The proposed construction will also consist of a stormwater management (SWM) facility to the east side of the proposed batting tunnel building.

GTA understands that upwards to five to fifteen feet of cut will be required within the building pad and bullpen areas with four to nine feet of cut within the SWM facility to achieve final grades.

SITE GEOLOGY

According to the Geologic Map of Wicomico County (1979) published by the Maryland Geological Survey, the site is within the Coastal Plain Physiographic Province. Coastal Plain sediments below the surficial deposits exposed in the site area were generally deposited in commonly estuarine environments of the Tertiary geologic age. The Upper and Middle Pliocene deposits are designated as the Walston Silt Formation. Sediments of the Walston Silt Formation typically consist of “Clay and silt, interstratified with poorly sorted clayey sand” Underlying the Walston Silt formation are the Upper and Middle Pliocene deposits designated as the Beaverdam Sand Formation. Sediments of the Beaverdam Sand Formation typically consist of “Sand and silty

sand locally interbedded with gravelly sand, clay-silt, and rare peaty sand or clay" Please refer to the publication for additional information. Man-made fill is anticipated at this site.

SUBSURFACE EXPLORATION

To characterize subsurface conditions, GTA performed ten Standard Penetration Test (SPT) borings, designated as B-1 through B-7 within the proposed prefab metal building/batting tunnels and retaining wall areas and SWM-1 through SWM-3 within the SWM area, at the relative locations shown on the attached Figure 2, Exploration Location Plan. The borings were drilled during February 2024, to depths of 14 to 20 feet below the ground surface using a Geoprobe 7822 DT drill rig.

Standard Penetration Testing was performed in the boreholes, with soil samples obtained at approximately 2-foot intervals within the upper 10-feet and at 5-foot intervals thereafter. Standard Penetration Testing involves driving a 2-inch O.D., 1⅜ -inch I.D. split-spoon sampler with a 140-pound hammer free-falling 30 inches. The SPT N-value, given as blows per foot (bpf), is defined as the total number of blows required to drive the sampler from 6 to 18 inches below the sampling depth.

Samples obtained from the borings were returned to GTA's office for visual classification by GTA personnel. Selected samples recovered from the field exploration were submitted for limited laboratory analysis. The soil layers were classified in accordance with the Unified Soil Classification System (USCS). Classifications provided on the logs are visual descriptions, supplemented by available laboratory data. The exploration logs are presented in Appendix B. The logs represent our interpretation of the field data based on observation and limited soil classification tests. The interfaces indicated on the logs may be gradual.

SUBSURFACE CONDITIONS

The soils were visually classified in accordance with the Unified Soil Classification System (USCS). Beneath an approximately 3-to-5-inch-thick surficial topsoil layer, the explorations encountered fill extending to depths of 4 to 13½ feet and visually classified as predominantly consisting of Silty SANDs (USCS: SM), Poorly-graded SANDs (SP), Poorly-graded SANDs with

Silt (SP-SM) and Well-graded SAND with Silt and Gravel (SW-SM). The relative densities of the fill were very loose to medium dense based on SPT N-values of 2 to 14 blows per foot (bpf). Most of the fill was loose.

Below the topsoil/fill layers, the explorations encountered native subsoils visually classified as predominantly consisting of Silty SANDs (USCS: SM), Clayey SANDs (SC), Poorly-graded SANDs (SP), Poorly-graded SANDs with Silt (SP-SM) and Silty Clayey SANDs (SC-SM). The relative densities of the granular soils were very loose to medium dense based on SPT N-values of 3 to 19 blows per foot (bpf). Most of the coarse-grained soils were generally loose.

A subordinate layer of Silty CLAYs with Sand (CL-ML) was encountered at Boring B-1 extending from approximately 17½ to the boring termination depth of 20 feet below the ground surface. The consistency of the fine-grained material was stiff based upon a SPT N-value of 11 bpf.

GTA's estimate of the seasonal high groundwater level is based upon water levels below seasonal highs, soil coloring, mottling and/or saturation. The results of the groundwater level readings and GTA's opinion of the estimated seasonal high groundwater depth are summarized as follows:

GROUNDWATER DATA SUMMARY

□ploration o.	□isting round urface levation	epth elow □isting round urface ft. levation to roundwater at ompletion	epth elow □isting round urface ft. levation to roundwater At ne to wo a□s After ompletion	epth elow □isting round urface ft. levation to stimated easonal igh roundwater
B-1	EL 62.7	Dry to 20.0 / Dry to EL 42.7	Dry to 20.0 / Dry to EL 42.7	20 / EL 43
B-2	EL 61.4	Dry to 20.0 / Dry to EL 41.4	Dry to 20.0 / Dry to EL 41.4	1 / EL 42
B-3	EL 60.0	Dry to 20.0 / Dry to EL 40.0	Dry to 20.0 / Dry to EL 40.0	18 / EL 42
B-4	EL 51.	Dry to 15.0 / Dry to EL 36.	Dry to 15.0 / Dry to EL 36.	10 / EL 42
B-5	EL 54.0	Dry to 15.0 / Dry to EL 3 .0	Dry to 15.0 / Dry to EL 3 .0	12 / EL 42
B-6	EL 54.	Dry to 15.0 / Dry to EL 3 .	Dry to 15.0 / Dry to EL 3 .	13 / EL 42
B-7	EL 52.4	Dry to 15.0 / Dry to EL 37.4	Dry to 15.0 / Dry to EL 37.4	10 / EL 42
SWM-1	EL 57.7	Dry to 14.0 / Dry to EL 43.7	Dry to 14.0 / Dry to EL 43.7	14 / EL 44
SWM-2	EL 55.6	Dry to 14.0 / Dry to EL 41.6	Dry to 14.0 / Dry to EL 41.6	14 / EL 42
SWM-3	EL 52.1	Dry to 14.0 / Dry to EL 38.1	Dry to 14.0 / Dry to EL 38.1	10 / EL 42

Seasonal high groundwater estimate based upon observed soil mottling, color and/or saturation and should be considered approximate.

The groundwater levels can be expected to fluctuate with seasonal changes, precipitation, and other factors such as development activity. Additionally, perched water conditions develop in granular soils overlying fine-grained and/or denser soils during the "wet season" and during heavy periods of precipitation. Please refer to the exploration logs provided in Appendix B for further information. Idealized subsurface profiles of the SWM and building borings are shown on Figure Nos. 3 and 4, Subsurface Profiles, in Appendix A.

LABORATORY TESTING

Selected samples obtained from the borings were tested for grain-size analysis, Atterberg Limits, moisture density relationship and natural moisture content. The grain-size analysis and Atterberg Limits testing were performed to evaluate the Unified Soil Classification System (USCS) designations for the soil. The results of testing are as follows:

SUMMARY OF LABORATORY TESTING

P A .	P .	A A		P	
B-1	4 – 6	Silty SAND (SM)	NP	NP	14.7
B-1	18.5 – 20	Silty CLA with Sand (CL-ML)	23	6	18.5
B-3	1 – 4	Well-graded SAND with Silt and Gravel (SW-SM)	NP	NP	10.
B-4	4 – 6	Poorly-graded SAND with Silt (SP-SM)	NP	NP	14.6
SWM-3	10 – 12	Silty Clayey SAND (SC-SM)	22	6	16.0

Note: LL Liquid Limit PI Plastic Index NP Non-plastic NM Natural Moisture Content NT Not Tested

A near surface, bulk sample was also tested for moisture-density relationship in accordance with the Modified Proctor (ASTM D-1557) method for use in evaluating the suitability of these soils for reuse as fill. Results of this tests is summarized in the following table.

SUMMARY OF COMPACTION
(ASTM D 1557, the Modified Proctor)

P A .	P	A P	P	A A
B-3	1 – 4	128.6	8.8	10.

Please refer to the laboratory test results included within Appendix C for additional information.

Three single ring, 5-inch diameter, falling head infiltration tests were also performed at locations offset from Borings SWM-1 through SWM-3. The infiltration test holes were pre-soaked prior to the falling head tests. Each test location was charged with a 24-inch head and the water level drop was recorded at 15 minutes or less intervals. The results of the infiltration tests, test depths, estimated seasonal high groundwater and soil type at each test location are summarized as follows:

SUMMARY OF INFILTRATION DATA

.	A A	epth elow isting round urface ft. levation to stimated easonal igh roundwater	A P A A	A A	A A A A A
SWM-1	EL 57.7	14 / EL 44	10.4 / EL 47.3	1 .0	Sand
SWM-2	EL 55.6	14 / EL 42	10.5 / EL 45.1	24.0	Sand
SWM-3	EL 52.1	10 / EL 42	6.0 / EL 46.1	2.0	Sandy Loam

Seasonal high groundwater estimate based upon observed soil mottling, color and/or saturation and should be considered approximate.

Infiltration tests performed in general accordance with *Maryland Stormwater Design Manual Appendix D.1 revised May 2009* and ASTM D-5126, as applicable.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of this study, it is our opinion that construction of the proposed improvements is feasible, given that the geotechnical recommendations are followed and that the standard level of care is maintained during construction. The existing fill will impact construction. GTA's preliminary recommendations are provided in the following paragraphs.

Earthwork

Before the placement of compacted fill, areas below proposed foundations and slabs should be stripped to remove topsoil, existing fill and soft materials within an oversized pad extending 10-feet beyond the tunnel building footprint on all sides where possible. It is GTA's opinion that pad oversizing will not be required in the bullpen areas since canopy and retaining wall footings should be lowered through fill and into native soils. The existing fill extends upwards to 6 to 8 feet below the finished floor elevation at the boring locations within the proposed tunnel building and 1 to 4 feet at the bullpen areas. The actual depth may vary. After stripping, subgrade areas should be proof-rolled with a loaded tandem-axle dump truck, performed as recommended by GTA. No

fill should be placed until the geotechnical engineer approves the subgrade. Wet soils near surface grade will result in poor trafficability. Positive drainage should be maintained during construction.

Precipitation will result in standing water at low areas and in localized undercut areas. Positive drainage should be provided to protect exposed subgrades. During wet season construction, GTA anticipates that the existing surficial soils may soften, and significant rutting may occur. If water is allowed to pond, the exposed subgrade materials may deteriorate, and additional over-excavation or subgrade improvement may be required at the affected areas. Depending on the level of precipitation and construction traffic routing, a contingency (cost per in-place cubic yard) should be established for undercut and replacement of soft soils.

Most near surface on-site soils beneath the topsoil, similar to the materials tested, are considered suitable for reuse as structural fill material including the existing fill. Excavated site materials conforming to SP, SP-SM or SM classifications will be suitable for reused as structural fill areas. During wet weather/site conditions, materials conforming to USCS SC, SC-SM, CL-ML, ML and CL will be more difficult to work and are not recommended for structural fill. These materials should be placed in designated green areas, properly disposed of offsite or reuse (CL and SC) materials in designated impervious zones of pond areas. The moisture of the bulk sample tested two percent above the optimum moisture content. At this indicated moisture level, site materials similar to the sample tested will require limited, if any, moisture adjustment. During wet weather or when excavating below or near groundwater, delays and expense will likely be associated with reducing soil moistures to acceptable levels.

For utility and site earthwork construction, the success of these operations will be largely dependent upon the weather conditions at the time of the earthwork construction. Summer construction season is recommended to reduce the premium cost for drying. A contingency should be established for moisture adjustments and importing suitable materials. If the work is performed during wet weather, offsite borrow may be required to complete the earthwork construction.

Deeper excavations, such as for sewer utility installations, may encounter groundwater. Consideration must be given to dewatering and stability of excavated slopes. Contractors should

provide adequate dewatering and earth support systems in utility trench excavations. Utility pipe systems below pavement and other structural areas should be backfilled using controlled, compacted fill conforming to USCS: SM, SP-SM or SP soils. The backfill should be constructed as described in our site grading recommendations. Lift thickness should be reduced to 4 inches when compacting with lightweight equipment around structures.

Dewatering through the use of "sump and pump" for trenches extending 1 to 2 feet below groundwater, in conjunction with well point techniques in deeper utility areas, may be required for utility installation. Most utility installations extended below fifteen feet may encounter groundwater.

Off-site borrow should meet Unified Soil Classification System (USCS) designation SM, SP, SW, GM, GP, or GW and be approved by GTA. All fills should be constructed in maximum 8-inch-thick loose lifts and be compacted to the following specifications:

COMPACTION SPECIFICATIONS

Structure / Fill Location	Compaction / Moisture Specification
Below foundations, floor slab subgrades and within wall backfill	95% of ASTM D 1557 Moisture: ± 3% of optimum
Lawn or unimproved areas	90% of ASTM D 1557 Moisture: optimum to ± 3% of optimum
SWM areas	95% of ASTM D 698 Moisture: ± 3% of optimum

A fulltime soils-technician under guidance of GTA should observe fill construction. Compactive effort should be verified by in-place density testing.

Surface and Subsurface Drainage

Final building pad and pavement grades should be carefully established to provide adequate surface drainage away from the foundations. Groundwater levels referenced in the *SUBSURFACE CONDITIONS* section of the report are, in our opinion, generally near seasonal high groundwater levels. Furthermore, soil layers containing appreciable amounts of silt or clay tend to perch groundwater at higher levels during wetter periods.

Foundations

It is GTA's opinion that the proposed batting tunnel building may be supported on native soils or structural fill using shallow reinforced concrete spread footings preliminarily designed for a maximum net allowable bearing pressure of 3,000 psf. Minimum widths for wall footings of 16 inches and column footings of 24 inches are recommended for footing construction. Exterior footings should be founded a minimum of 24 inches below the final exterior grades to provide protection from frost action. In areas where new footings will abut existing footings, the new footing bottom depth should be adjusted to match the existing footing bottom. Post construction settlement of less than 1-inch total and ½-inch differential can be anticipated, based upon this design and typical construction loads.

Footing excavations for the canopies and retaining walls within the bullpen areas should be lowered through the existing fill to expose firm native soils. With a frost depth of 24-inches, the footings may need to be lowered one to two feet beyond the frost depth to expose firm native soils.

Where very loose, soft or unsuitable fill materials are encountered, the footing excavations should be undercut and the subgrade should be reestablished with AASHTO No. 57 crushed stone, flowable fill or lean concrete and in accordance with GTA's recommendations in the field at the time of construction.

Detailed foundation evaluations should be performed in each footing excavation prior to the placement of reinforcing steel or concrete. These evaluations should be performed by a representative of the GTA to confirm that the allowable soil bearing capacity is available. The foundation bearing surface evaluations should be performed using a combination of visual observation, comparison with the borings, hand-rod probing, and Dynamic Cone Penetrometer (DCP) testing. Concrete should be placed on the day the footings are excavated.

Floor Slabs

The ground floors should be designed as concrete slab-on-grade. GTA recommends that the concrete floor slabs supported on grade be founded on a four-inch thick open-graded stone

layer (AASHTO # 57 stone) covered with a polyethylene vapor retarder to interrupt the rise of moisture through the slab. Natural and compacted fill subgrades for support of the floor slabs should be tested to verify stability and compaction in accordance with GTA's earthwork recommendations prior to placement of concrete. Control joints should be provided to control shrinkage cracking of the concrete floor system. A modulus of subgrade reaction value of 150 psi per inch is recommended for the design of the building slabs.

Seismic Information

It is GTA's opinion that the soil conditions at this site can be categorized as Site Class D per the ASCE/SEI Standard 7-22 and the 2015 International Building Code. This categorization is based on the near surface test boring results, general geologic information for the region, and the information contained in the ASCE/SEI Standard 7-22 and IBC 2015 codes.

Stormwater Management Facilities

The guidelines established in the *Maryland Stormwater Design Manual Appendix D.1*, revised May 2009, indicate that the minimum field infiltration rate for infiltration trenches and basins practices is 0.52-inch per hour. Also, a vertical separation of at least two-feet from the seasonal high groundwater elevation or limiting layer is required for all infiltration practices on the Lower Eastern Shore unless an underdrain is provided. Maryland NRCS Pond Code 378 is recommended for SWM pond construction.

Predominant on-site soils within the SWM area consist of USCS SP, SM and SC-SM below existing fill, which generally correspond to USDA Sand, Sandy Loam, and Sandy Clay Loam respectively. Sand is generally considered good for infiltration practices, Sandy Loam is generally considered marginal for infiltration practices, while Sandy Clay Loam is generally considered poor for infiltration practices. Based upon the field infiltration rates and using a factor of safety of two for the 5-inch diameter tests, GTA recommends the following for infiltration rates for the SWM design.

SUMMARY OF INFILTRATION SUITABILITY

A A	P A P	A A A A A	A A P A	A A A	A A A
SWM-1	Sand	EL 44	Suitable	EL 46 to 47	7.6
SWM-2	Sand	EL 42	Suitable	EL 44 to 45	.6
SWM-3	Sandy Loam	EL 42	Marginal	EL 45 to 46	0.8

FS 2.0

GTA recommends that infiltration facilities be excavated using a track-mounted excavator, which will generally eliminate the need to operate equipment directly on the subgrade. If underground facilities are proposed, the subgrade should be hand cleaned using a shovel to remove any disturbed soil prior to placing the foundation stone below the chambers. GTA should be consulted for additional recommendations regarding a soil bearing capacity for design purposes for underground facilities.

To facilitate placement in the Sand layers, the actual facility bottom elevation will vary and should be adjusted as required in the field based upon the observed conditions at the time of construction. In areas where less permeable soils are encountered at the basin bottom up to within two feet below the facility bottom, the soils should be over excavated and replaced with ASTM C33 Concrete Sand.

For wet pond construction, if considered, a pond liner should be considered to help maintain desired pool levels. It appears that a sufficient quantity of USCS CL or SC materials will not be available on site and a manufactured pond liner will be more suitable for a wet pond. GTA recommends a Geosynthetic Clay Liner (GCL; Bentonite matrix) or an appropriate PVC liner with relief valves. Both types of liners will need to be provided with a 1-foot-thick granular soil cover. The GCL or PVC liners should be installed in accordance with manufacturer's recommendations. On-site granular soils are considered suitable for use as a pond liner cover material if they are dried to near optimum. Pond liner cover materials should meet AASHTO classification designation A-2-4 or more granular and be approved by GTA. Normal seasonal groundwater variation may result in several feet of pool level fluctuation with changing seasons. An artificial water source (e.g., agricultural well) should be considered to maintain the permanent pool during extended dry periods.

For wet pond construction, groundwater levels will likely be above the pond bottom level during construction. The contractor should be prepared to stabilize and dewater pond excavations. Subgrades excavated below the water table will be prone to instability and softening. All SWM pond construction should conform to *NRCS Maryland Standard Pond Code 378*, latest edition and Maryland Department of Environment (MDE) requirements, as applicable.

Prior to construction of pond fill embankment and after stripping the surface topsoil, GTA recommends constructing a four-foot deep (below stripped ground surface and stepped below the spillway invert) cutoff trench along the pond embankment length and extending to the 10-year event elevation at each end of the fill embankment alignment. Also, upon completion of the cutoff trench, an embankment core should extend to the top elevation of the 10-year event. The side slopes of the cutoff trench and embankment core should be at 1H:1V inclination or flatter. The bottom of the cutoff trench and the top of embankment core should be at least 4 feet wide. The cutoff and embankment core should be formed of USCS CL or SC materials. The balance of embankment may be constructed of onsite materials conforming to USCS SC, SM, SP-SM or SP.

Structural fill should be constructed in maximum 8-inch loose lifts and compacted to 95 percent of the maximum dry density as determined by ASTM D-698 (AASHTO T-99). If practical, GTA recommends reinforced concrete pipe be used as the principal spillway pipe. Also, a concrete cradle and anti-seep collar should be provided for the spillway pipe.

Retaining Wall Construction

Retaining walls should be designed to resist lateral earth pressures and be provided with a properly outletted drain system to assure against the buildup of hydrostatic pressure from natural or unnatural sources following construction. A surface surcharge should be added to reflect proposed uses behind the wall. GTA recommends that the following soil design parameters be used for the design of the retaining walls:

Friction Angle	φ = 30 degrees
Active Pressure Coefficient*	K_a = 0.33
At Rest Pressure Coefficient*	K_o = 0.5
Passive Pressure Coefficient*	K_p = 3.0
Moist Unit Weight of Soil	130 pcf
Saturated Unit Weight of Soil	135 pcf
Submerged Unit Weight of Soil	73 pcf
Allowable Soil Bearing Pressure	2,000 psf
Soil/Concrete Coefficient of Friction	0.4
*Level backfill condition	

Retaining walls should be founded upon native soils or structural fill. Soil used for backfill for retaining walls should be non-plastic and have less than 15 percent passing the No. 200 sieve. Values in the above table assume minimum compaction of 95 percent of the Modified Proctor. While most onsite soils should comply, select borrow material meeting these requirements may need to be borrowed from other areas of the site. Select borrow material used for the retaining walls should be approved by GTA for the intended usage.

ADDITIONAL SERVICES

We recommended that during construction of the subject project, GTA be retained to provide observation and testing services for the following items.

- Review of final grades, structural loads and construction plans when established to evaluate if they conform with the intent of this report.
- Provide testing observation and services during fill placement to evaluate if the work is being performed in accordance with the project specifications and intent of this report.
- Observe the proof-rolling of pad subgrades prior to placing fill or base course to evaluate stability.
- Observe foundation and slab construction for conformance with the project drawings and the intent of this geotechnical report.

LIMITATIONS

This report, including all supporting exploration logs, field data, field notes, laboratory test data, calculations, estimates, and other documents prepared by GTA in connection with this

project, has been prepared for the exclusive use of McCrone Engineering pursuant to the agreements between GTA and McCrone Engineering dated January 26, 2024 and in accordance with generally accepted engineering practice. All terms and conditions set forth in the Agreement and the General Provisions attached thereto are incorporated herein by reference. No warranty, express or implied, is given herein. Use and reproduction of this report by any other person without the expressed written permission of GTA and McCrone Engineering is unauthorized and such use is at the sole risk of the user.

The analysis and preliminary recommendations contained in this report are based on the data obtained from limited observation and testing of the encountered materials. Test borings indicate soil conditions only at specific locations and times and only at the depths penetrated. They do not necessarily reflect strata or variations that may exist between test boring locations. Consequently, the analysis and recommendations must be considered preliminary until the subsurface conditions can be verified by direct observation at the time of construction. If variations of subsurface conditions from those described in this report are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed, and conclusions of this report are verified in writing. Geo-Technology Associates, Inc. is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis without the expressed written authorization of Geo-Technology Associates, Inc.

The scope of our services for this geotechnical exploration did not include any environmental assessment or investigation for the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the logs regarding odors or unusual or suspicious items or conditions observed are strictly for the information of our Client. This report and the attached logs are instruments of service. The subject matter of this report is limited to the facts and matters stated

herein. Absence of a reference to any other conditions or subject matter shall not be construed by the reader to imply approval by the writer.

31240250 **GEO-TECHNOLOGY ASSOCIATES, INC.**

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

re.
en
would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note* "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org

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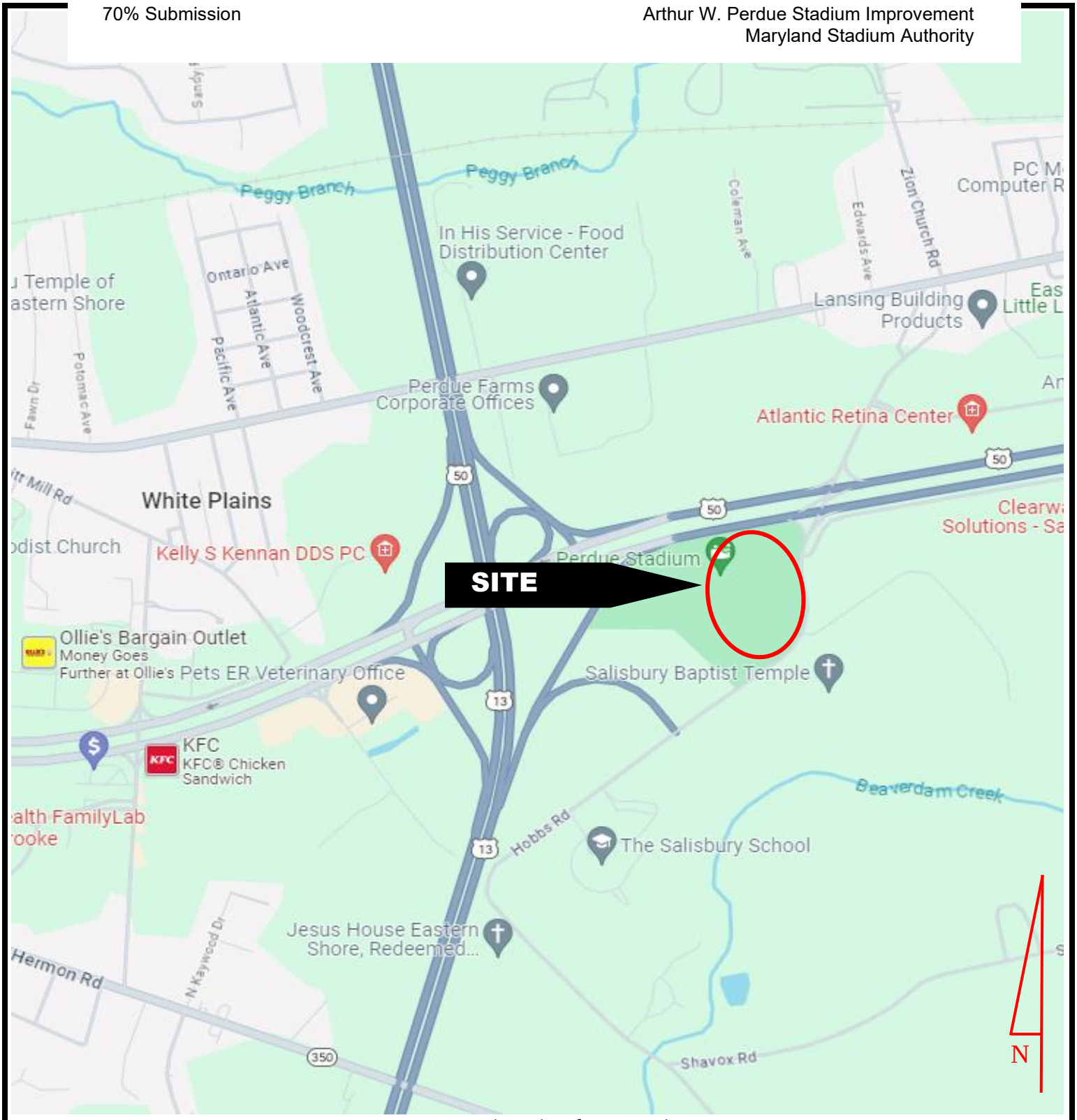
APP A

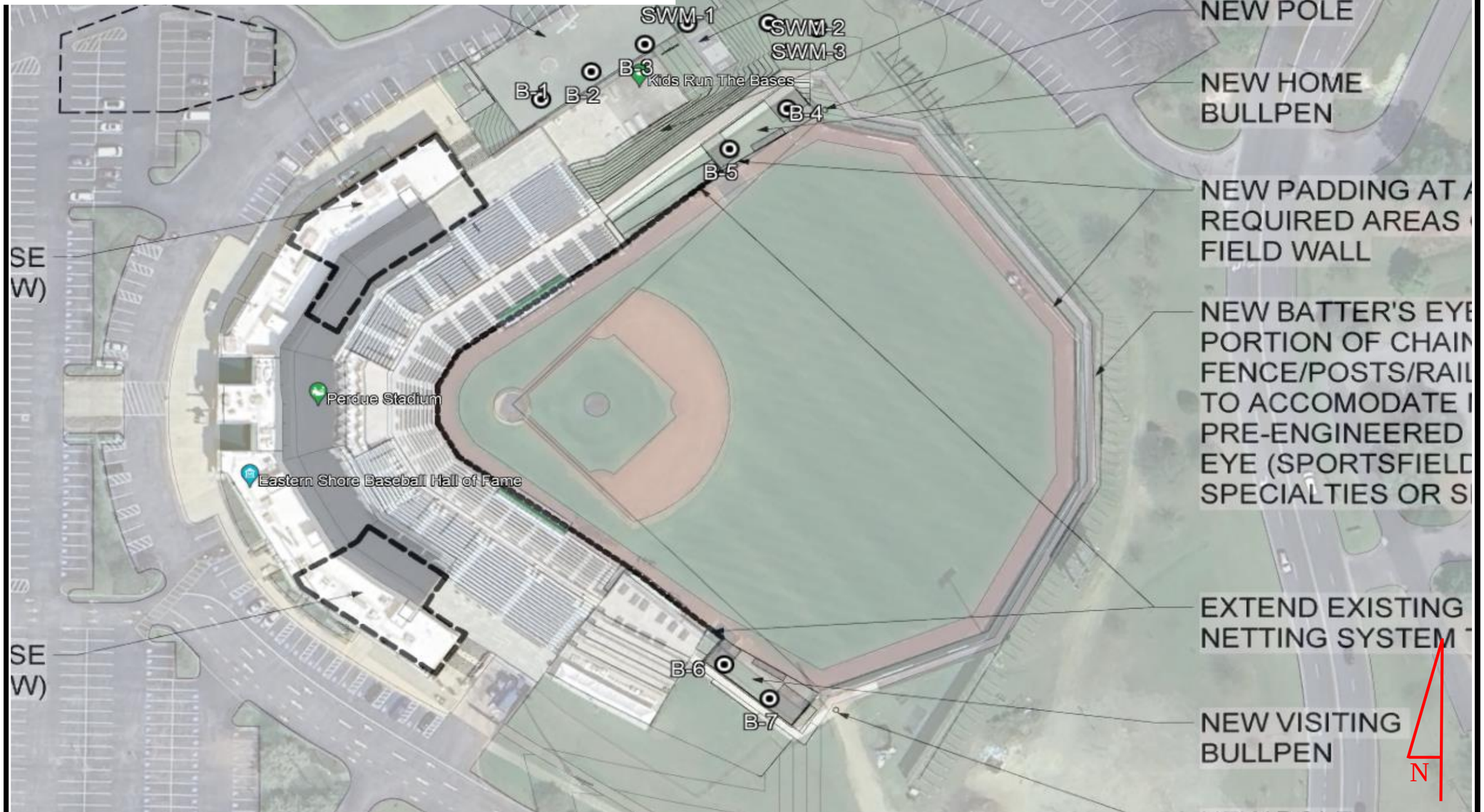


Site Location Plan taken from Google Maps

GTA	**A A .** *GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS* 214 1 Baltimore Avenue, Unit 1 Georgetown, Delaware 1 47 (302) 855- 761	**ite ocation Plan** **Arthur . Perdue tadium pgrades** **icomico ount ar land**

A	**A**	**A**	GTA	Google Maps	GRS	. 31240250

EwingCole
Project No. 20230573

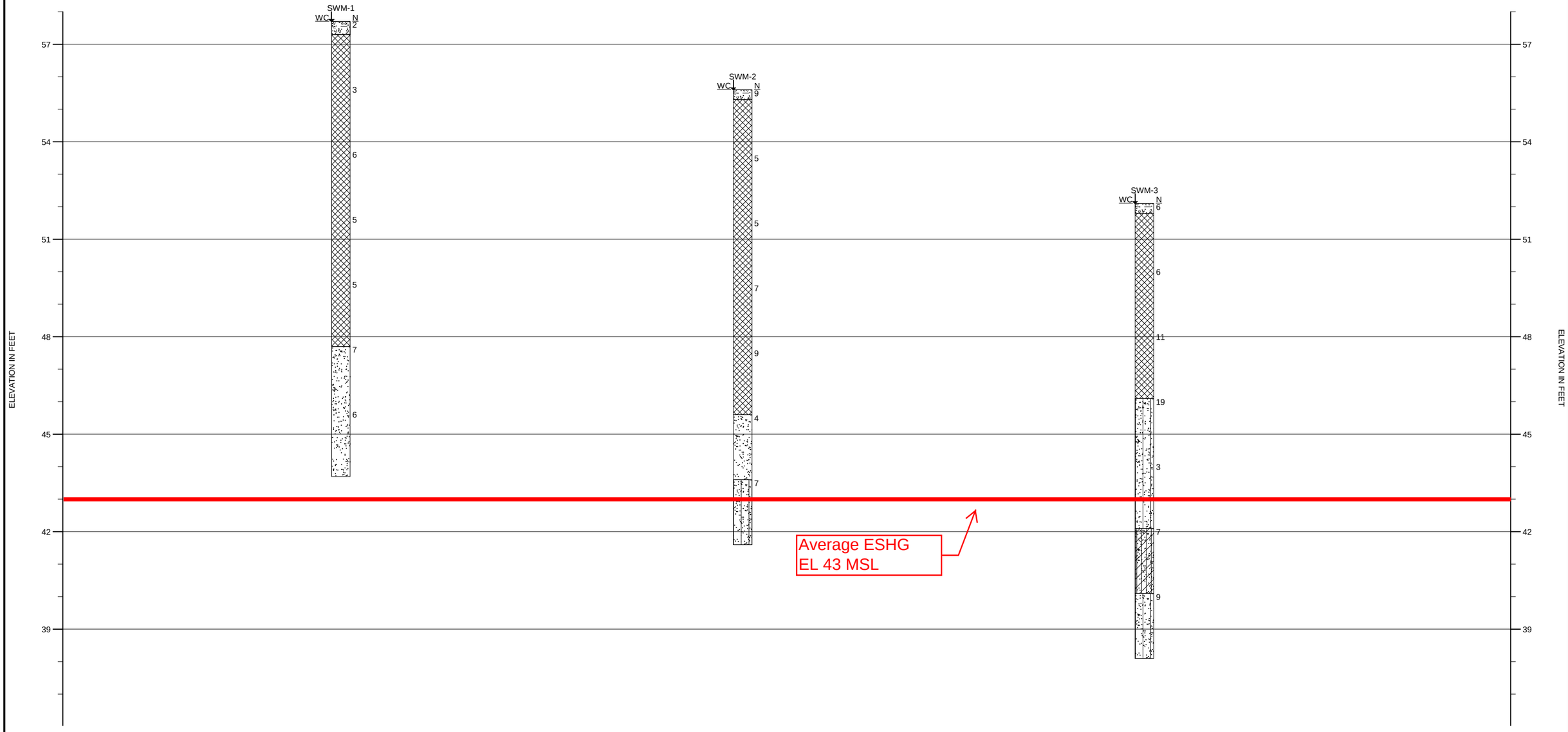


Exploration Location Plan taken from Google Earth and a site plan titled *Perdue Stadium - PDL Compliance* prepared by Ewing Cole and dated January 16, 2024.

Boring Location

GTA	A A . *GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS* 214 1 Baltimore Avenue, Unit 1 Georgetown, Delaware 1 47 (302) 855- 761	**ploration ocation Plan Arthur . Perdue tadium pgrades icomico ount ar land**				
A	A	A			.	igure
1 80'	March 2024	GTA	Ewing Cole	TPC	31240250	2

EwingCole
Project No. 20230573



Symbol Description

- Topsoil
- Existing Fill
- SP - Poorly Graded Sand
- SM - Silty Sand
- SC-SM - Silty Clayey Sand
- ↓ Approximate horizontal location of exploration

Geo-Technology Associates, Inc.

SUBSURFACE PROFILE

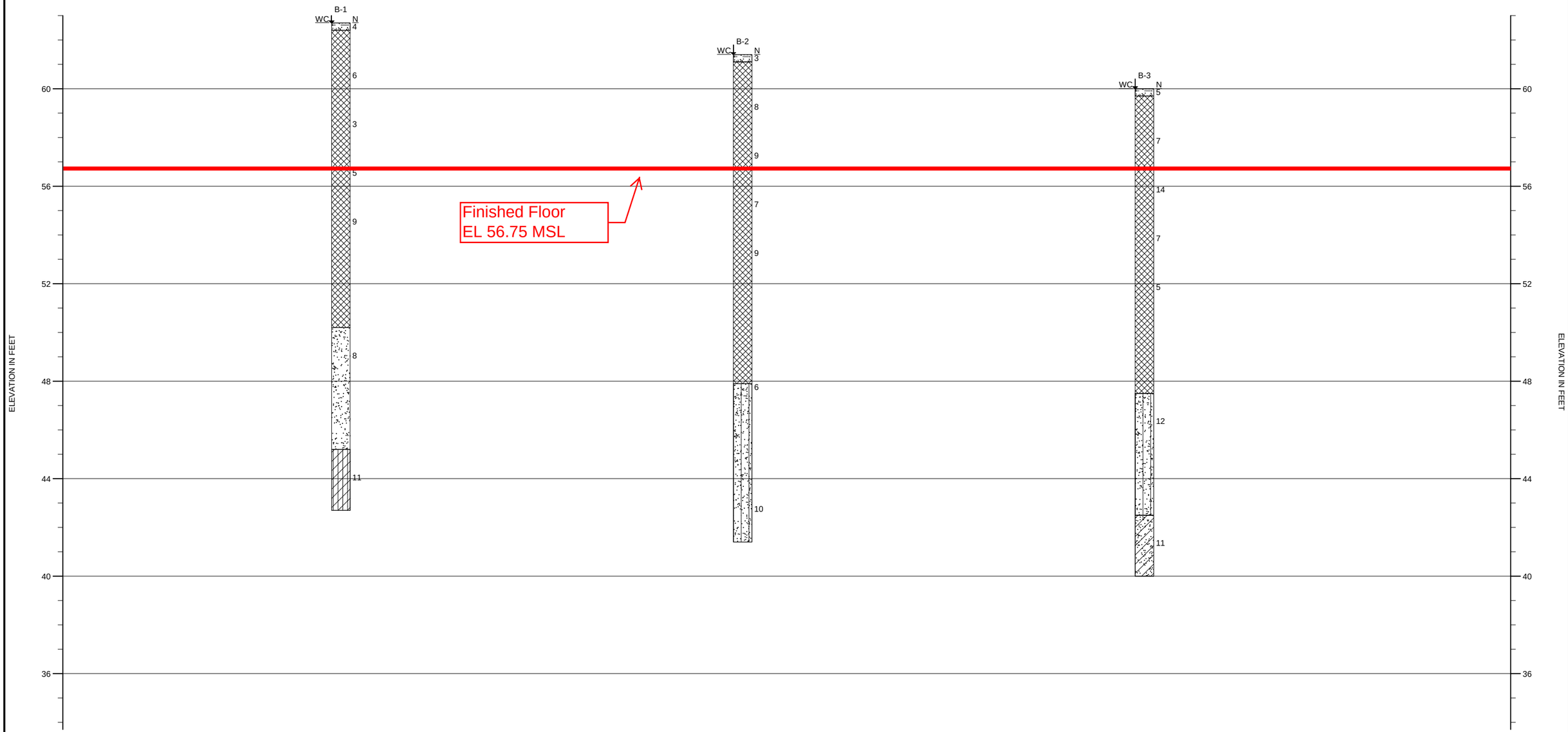
VERTICAL SCALE: 1"=3'	DRAWN BY WLG	APPROVED BY TPC	DATE: 4/5/2024

Arthur W. Perdue Stadium Upgrades
Wicomico County, Maryland

PROJECT NO. 31240250 | FIGURE 3

EwingCole
Project No. 20230573

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority



Symbol Description

- Topsoil
- Existing Fill
- SP - Poorly Graded Sand
- CL-ML - Silty Clay
- SM - Silty Sand
- SP-SM - Poorly Graded Sand with Silt
- SC - Clayey Sand
- ↓ Approximate horizontal location of exploration

Geo-Technology Associates, Inc.			
SUBSURFACE PROFILE			
VERTICAL SCALE: 1"=4'	DRAWN BY WLG	APPROVED BY TPC	DATE: 4/5/2024
Arthur W. Perdue Stadium Upgrades Wicomico County, Maryland			
PROJECT NO. 31240250		FIGURE 4	

EwingCole
Project No. 20230573

APP

P A A A

MAJOR DIVISIONS (BASED UPON ASTM D 2488)				SYMBOLS GRAPHIC	SYMBOLS LETTER
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 15% PASSING THE NO. 200 SIEVE)			GW
					GP
		GRAVELS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)			GM
					GC
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LESS THAN 15% PASSING THE NO. 200 SIEVE)			SW
					SP
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)			SM
					SC
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILT OR CLAY (<15% RETAINED ON THE NO. 200 SIEVE) SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED ON THE NO. 200 SIEVE) SANDY OR GRAVELLY SILT OR CLAY (>30% RETAINED ON THE NO. 200 SIEVE)	SILTS AND LEAN CLAYS LIQUID LIMIT LESS THAN 50			ML
					CL
					OL
		ELASTIC SILTS AND FAT CLAYS LIQUID LIMIT GREATER THAN 50			MH
					CH
					OH
HIGHLY ORGANIC SOILS					PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS WHICH CONTAIN AN ESTIMATED 5 TO 15% FINES BASED ON VISUAL CLASSIFICATION OR BETWEEN 5 AND 12% FINES BASED ON LABORATORY TESTING; AND FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSS-HATCHED AREA. FINE-GRAINED SOILS ARE CLASSIFIED AS ORGANIC (OL OR OH) WHEN ENOUGH ORGANIC PARTICLES ARE PRESENT TO INFLUENCE ITS PROPERTIES. LABORATORY TEST RESULTS ARE USED TO SUPPLEMENT SOIL CLASSIFICATION BY THE VISUAL-MANUAL PROCEDURES OF ASTM D 2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

	DESCRIPTION	GRAPHIC SYMBOLS
ADDITIONAL DESIGNATIONS	TOPSOIL	
	MAN MADE FILL	
	GLACIAL TILL	
	COBBLES AND BOULDERS	

RESIDUAL SOIL DESIGNATIONS	DESCRIPTION	"N" VALUE	
	HIGHLY WEATHERED ROCK	50 TO 50/1"	
		MORE THAN 50 BLOWS FOR 1" OF PENETRATION OR LESS, AUGER PENETRABLE	

(GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D 1586

FINE-GRAINED SOILS
(SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SOIL SAMPLE	S-
SHELBY TUBE	U-
ROCK CORE	R-

WATER DESIGNATION

DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	
UPON COMPLETION OF DRILLING	
24 HOURS AFTER COMPLETION	

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **62.7**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					62.7	0				
1	0.0	24	2-2-2-2	4	62.4		TS		Topsoil: 4 inches	
							FILL		Brown, moist, very loose to loose, Poorly-graded SAND (Fill)	
2	2.0	18	3-3-3-3	6		4				
3	4.0	20	1/12-2-1	3					Brown, moist, very loose to loose, Silty SAND (Fill)	
4	6.0	14	2-2-3-5	5		8				
5	8.0	20	2-5-4-5	9					Brown, moist, loose, Poorly-graded SAND with Silt (Fill)	
						12				
					50.2		SP		Tan, moist, loose, Poorly-graded SAND	
6	13.5	10	3-4-4-5	8						
						16				
					45.2		CL-ML		Gray, moist, stiff, Silty CLAY with Sand	
7	18.5	10	3-5-6	11						
					42.7	20			Bottom of hole 20 feet	
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-1

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **61.4**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					61.4	0				
1	0.0	24	2-1-2-3	3	61.1		TS		Topsoil: 4 inches	
							FILL		Brown, moist, very loose to loose, Poorly-graded SAND with Silt (Fill)	
2	2.0	20	2-3-5-6	8						
						4			Brown, moist, loose, Poorly-graded SAND (Fill)	
3	4.0	18	3-4-5-5	9						
									Brown, moist, loose, Poorly-graded SAND with Silt (Fill)	
4	6.0	20	3-3-4-3	7						
						8				
5	8.0	20	5-4-5-5	9						
						12				
					47.9					
6	13.5	18	3-3-3	6			SM		Dark gray, moist, loose, Silty SAND with Trace Organics	
						16			Tan, moist, loose, Silty SAND	
7	18.5	18	3-5-5	10						
					41.4	20			Bottom of hole 20 feet	
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-2

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/29/2024**
DATE COMPLETED: **2/29/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **60.0**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					60.0	0	TS		Topsoil: 3 inches	
1	0.0	10	1-2-3-3	5	59.7		FILL		Brown, moist, loose, Well-graded SAND with Silt and Gravel (Fill)	
2	2.0	25	3-3-4-7	7		4			Gray, moist, medium dense, Poorly-graded SAND (Fill)	
3	4.0	24	6-7-7-6	14					Brown, moist, loose, Poorly-graded SAND with Silt (Fill)	
4	6.0	24	2-3-4-6	7		8				
5	8.0	24	1-2-3-3	5						
					47.5	12	SP-SM		Brown, moist, medium dense, Poorly-graded SAND with Silt	
6	13.5	18	6-6-6	12		16				
					42.5		SC		Gray-tan, moist, medium dense, Clayey SAND	
7	18.5	18	3-5-6	11						
					40.0	20			Bottom of hole 20 feet	
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-3

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **51.9**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					51.9	0	TS		Topsoil: 3 inches	
1	0.0	10	2-3-3-3	6	51.6		FILL		Brown, moist, loose, Silty SAND with Gravel (Fill)	
2	2.0	15	3-5-3-3	8		4				
3	4.0	18	1/12-2-3	2					Brown, moist, very loose, Poorly-graded SAND with Silt (Fill)	
4	6.0	20	3-3-4-3	7	45.9		SM		Brown, moist, loose, Silty SAND	
5	8.0	23	3-3-3-3	6	43.9	8	SP-SM		Tan, moist, loose, Poorly-graded SAND with Silt	
					39.4	12	SM		Brown-gray, moist, loose, Silty SAND	
6	13.5	18	2-3-4	7						
					36.9	16			Bottom of hole 15 feet	
						20				
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-4

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **54.0**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					54.0	0				
1	0.0	24	5-5-7-5	12	53.7		TS		Topsoil: 3 inches	
							FILL		Brown, moist, loose to medium dense, Poorly-graded SAND with Silt (Fill)	
2	2.0	24	2-2-5-4	7						
						4			Brown, moist, loose, Silty SAND (Fill)	
3	4.0	15	3-4-4-4	8						
					48.0					
4	6.0	20	4-4-4-4	8			SM		Brown, moist, loose to medium dense, Silty SAND with Gravel	
						8				
5	8.0	24	2-4-8-7	12						
						12				
6	13.5	18	3-3-5	8						
					39.0				Bottom of hole 15 feet	
						16				
						20				
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-5

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/29/2024**
DATE COMPLETED: **2/29/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **54.9**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					54.9	0	TS		Topsoil: 3 inches	
1	0.0	24	5-6-6-10	12	54.6		FILL		Brown, moist, medium dense, Silty SAND (Fill)	
2	2.0	20	7-7-6-5	13					Brown-gray, moist, very loose to medium dense, Poorly-graded SAND with Silt (Fill)	
3	4.0	24	2-2-2-2	4		4				
4	6.0	18	5-5-5-6	10	48.9		SM		Brown, moist, loose, Silty SAND	
5	8.0	22	1-1-2-5	3	46.9	8	SP		Tan, moist, very loose, Poorly-graded SAND	
						12				
6	13.5	18	3-6-5	11	42.4		SM		Gray, moist, medium dense, Silty SAND	
					39.9				Bottom of hole 15 feet	
						16				
						20				
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-6

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/29/2024**
DATE COMPLETED: **2/29/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **52.4**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					52.4	0	TS		Topsoil: 3 inches	
1	0.0	24	1-5-6-4	11	52.1		FILL		Brown, moist, medium dense, Silty SAND (Fill)	
2	2.0	18	4-3-4-3	7					Brown, moist, loose, Poorly-graded SAND with Silt (Fill)	
3	4.0	15	1-1-4-3	5	48.4	4	SP		Tan, moist, loose, Poorly-graded SAND	
4	6.0	20	3-3-3-1	6	46.4		SM		Tan-gray, moist, loose to medium dense, Silty SAND	
5	8.0	20	4-6-7-7	13		8				
						12				
6	13.5	18	5-7-9	16						
					37.4				Bottom of hole 15 feet	
						16				
						20				
						24				

NOTES: **NE = Not Encountered**

GEO-TECHNOLOGY

LOG OF BORING NO. B-7

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **57.7**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					57.7	0	TS		Topsoil: 5 inches	
1	0.0	24	1-1-1-2	2	57.3		FILL		Brown, moist, very loose to loose, Poorly-graded SAND (Fill)	
2	2.0	23	1-1-2-4	3		4				
3	4.0	24	2-3-3-4	6						
4	6.0	18	2-3-2-3	5		8				
5	8.0	24	1-2-3-4	5						
6	10.0	24	2-3-4-5	7	47.7	12	SP		Tan, moist, loose, Poorly-graded SAND USDA: Sand	
7	12.0	24	2-3-3-2	6						
					43.7	16			Bottom of hole 14 feet	
						20				
						24				

NOTES: **Air Temp.: 67, 48 Hr. Precip.: 0.0 in., Coords: 38022'14.55"N, 75031'47.22"W**
ASTM 1586, NE = Not Encountered

GEO-TECHNOLOGY

LOG OF BORING NO. SWM-1

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽ **NE**
GROUND SURFACE ELEVATION: **55.6**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					55.6	0	TS		Topsoil: 3 inches	
1	0.0	20	3-4-5-5	9	55.3		FILL		Brown, moist, loose, Silty SAND (Fill)	
2	2.0	18	3-3-2-3	5					Brown, moist, loose, Poorly-graded SAND (Fill)	
3	4.0	24	3-3-2-4	5		4			Dark gray, moist, loose, Silty SAND (Fill)	
4	6.0	24	2-5-2-2	7					Brown, moist, loose, Poorly-graded SAND (Fill)	
5	8.0	24	2-4-5-4	9		8				
6	10.0	20	2-2-2-2	4	45.6		SP		Tan, moist, very loose, Poorly-graded SAND USDA: Sand	
7	12.0	24	2-3-4-5	7	43.6	12	SM		Brown, moist, loose, Silty SAND USDA: Sandy Loam	
					41.6				Bottom of hole 14 feet	
						16				
						20				
						24				

NOTES: **Air Temp.: 67, 48 Hr. Precip.: 0.0 in., Coords: 38022'14.56"N, 75031'46.51"W**
ASTM 1586, NE = Not Encountered

GEO-TECHNOLOGY

LOG OF BORING NO. SWM-2

EwingCole
Project No. 20230573

70% Submission

Arthur W. Perdue Stadium Improvement
Maryland Stadium Authority

PROJECT LOCATION: **Wicomico County, Maryland**

CAVED (ft): - - -

DATE STARTED: **2/28/2024**
DATE COMPLETED: **2/28/2024**
DRILLING CONTRACTOR: **Geo-Technology Associates, Inc.**
DRILLER: **J. Fairbank**
DRILLING METHOD: **Hollow Stem Auger**
SAMPLING METHOD: **Splitspoon**

WATER ENCOUNTERED DURING DRILLING (ft) ▽: **NE**
GROUND SURFACE ELEVATION: **52.1**
DATUM: **Survey**
EQUIPMENT: **Geoprobe 7822DT**
LOGGED BY: **NO**
CHECKED BY: **T. Caraway**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					52.1	0	TS		Topsoil: 4 inches	
1	0.0	24	2-3-3-3	6	51.8		FILL		Brown-tan, moist, loose to medium dense, Poorly-graded SAND (Fill)	
2	2.0	24	4-3-3-6	6		4				
3	4.0	22	3-4-7-7	11						
4	6.0	24	7-9-10-8	19	46.1		SM		Brown, moist, very loose to medium dense, Silty SAND USDA: Sandy Loam	
5	8.0	17	1-2-1-8	3		8				
6	10.0	24	3-3-4-4	7	42.1		SC-SM		Brown-gray, moist, loose, Silty, Clayey SAND USDA: Sandy Clay Loam	
7	12.0	20	5-5-4-2	9	40.1	12	SM		Gray-tan, moist, loose, Silty SAND USDA: Sandy Loam	
					38.1				Bottom of hole 14 feet	
						16				
						20				
						24				

NOTES: **Air Temp.: 67, 48 Hr. Precip.: 0.0 in., Coords: 38°22'14.53"N, 75°31'46.08"W**
ASTM 1586, NE = Not Encountered

GEO-TECHNOLOGY

LOG OF BORING NO. SWM-3

EwingCole
Project No. 20230573

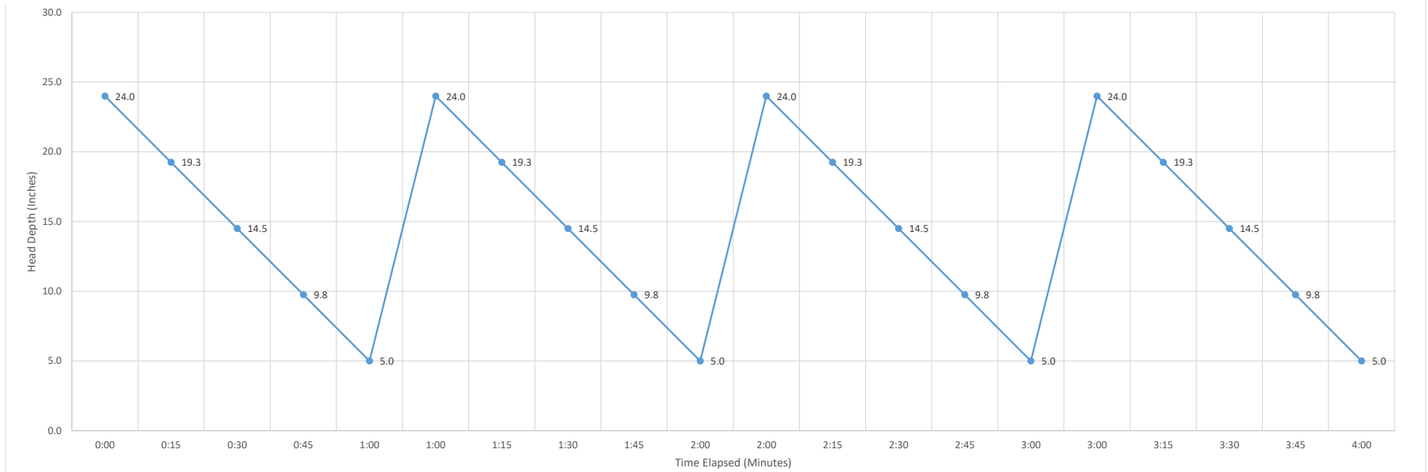
Single Ring Falling Head Infiltration Testing

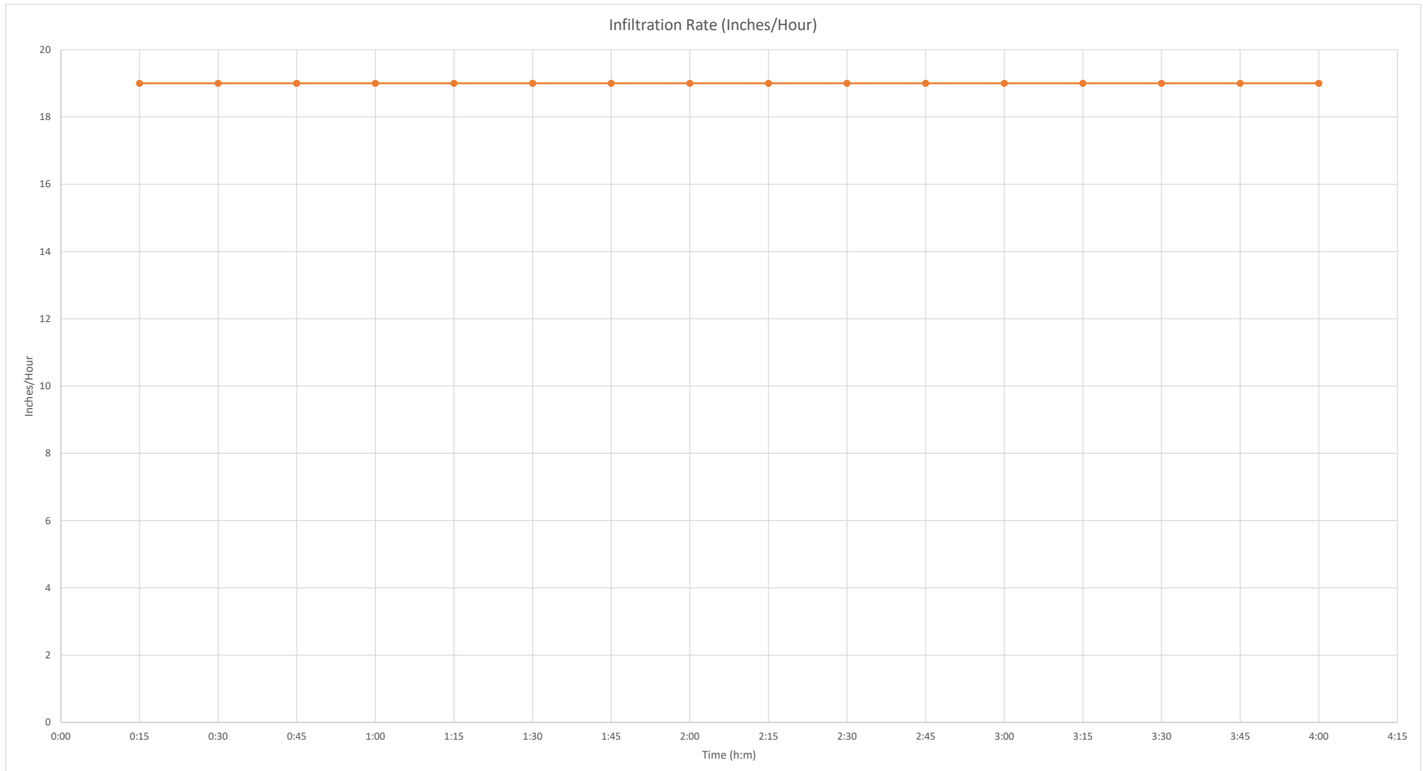
Name: Mitchell
I. D. of Pipe: 5 in.
Test Depth: 10.4 / 47.3 ft. / EL
Depth of Casing Penetration: 1"
Soil Type Tested: Sand

Date 3/20/2024
Temp _66°F_ Weather: Sunny
Rainfall Last 24 hrs. __0.0"___
Location: ___SWM-1_____
Presoak : 12" drop / 1+ hour

Date	Time	Δt (h:m)		Head of Water (in.)	Infiltration Rate (in/hr)	Comments
3/20/2024	11:00 AM	0:00		24.0		
	11:15 AM	0:15		19.3	19.0	
	11:30 AM	0:30		14.5	19.0	
	11:45 AM	0:45		9.8	19.0	
	12:00 PM	1:00		5.0	19.0	
	12:00 PM	1:00		24.0		
	12:15 PM	1:15		19.3	19.0	
	12:30 PM	1:30		14.5	19.0	
	12:45 PM	1:45		9.8	19.0	
	1:00 PM	2:00		5.0	19.0	
	1:00 PM	2:00		24.0		
	1:15 PM	2:15		19.3	19.0	
	1:30 PM	2:30		14.5	19.0	
	1:45 PM	2:45		9.8	19.0	
	2:00 PM	3:00		5.0	19.0	
	2:00 PM	3:00		24.0		
	2:15 PM	3:15		19.3	19.0	
	2:30 PM	3:30		14.5	19.0	
	2:45 PM	3:45		9.8	19.0	
	3:00 PM	4:00		5.0	19.0	

Steady State Infiltration Rate 19.0





Arthur W. Perdue Stadium Upgrades
31240250

Location: SWM-1
Test Depth: 10.4

Single Ring Falling Head Infiltration Testing

Name: Mitchell
I. D. of Pipe: 5 in.
Test Depth: 10.5 / 45.1 ft. / EL
Depth of Casing Penetration: 1"
Soil Type Tested: Sand

Date 3/20/2024
Temp _66°F_ Weather: Sunny
Rainfall Last 24 hrs. __0.0"___
Location: ___SWM-2_____
Presoak : 12" drop / 1+ hour

Date	Time	Δt (h:m)		Head of Water (in.)	Infiltration Rate (in/hr)	Comments
3/20/2024	11:00 AM	0:00		24.0		
	11:15 AM	0:15		18.0	24.0	
	11:30 AM	0:30		12.0	24.0	
	11:45 AM	0:45		6.0	24.0	
	12:00 PM	1:00		0.0	24.0	
	12:00 PM	1:00		24.0		
	12:15 PM	1:15		18.0	24.0	
	12:30 PM	1:30		12.0	24.0	
	12:45 PM	1:45		6.0	24.0	
	1:00 PM	2:00		0.0	24.0	
	1:00 PM	2:00		24.0		
	1:15 PM	2:15		18.0	24.0	
	1:30 PM	2:30		12.0	24.0	
	1:45 PM	2:45		6.0	24.0	
	2:00 PM	3:00		0.0	24.0	
	2:00 PM	3:00		24.0		
	2:15 PM	3:15		18.0	24.0	
	2:30 PM	3:30		12.0	24.0	
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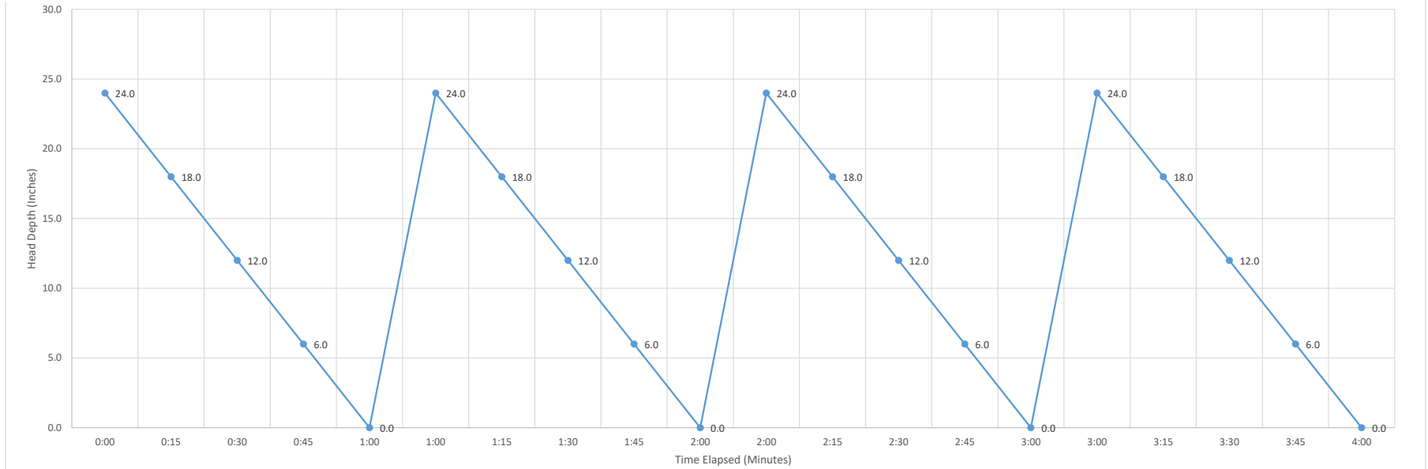
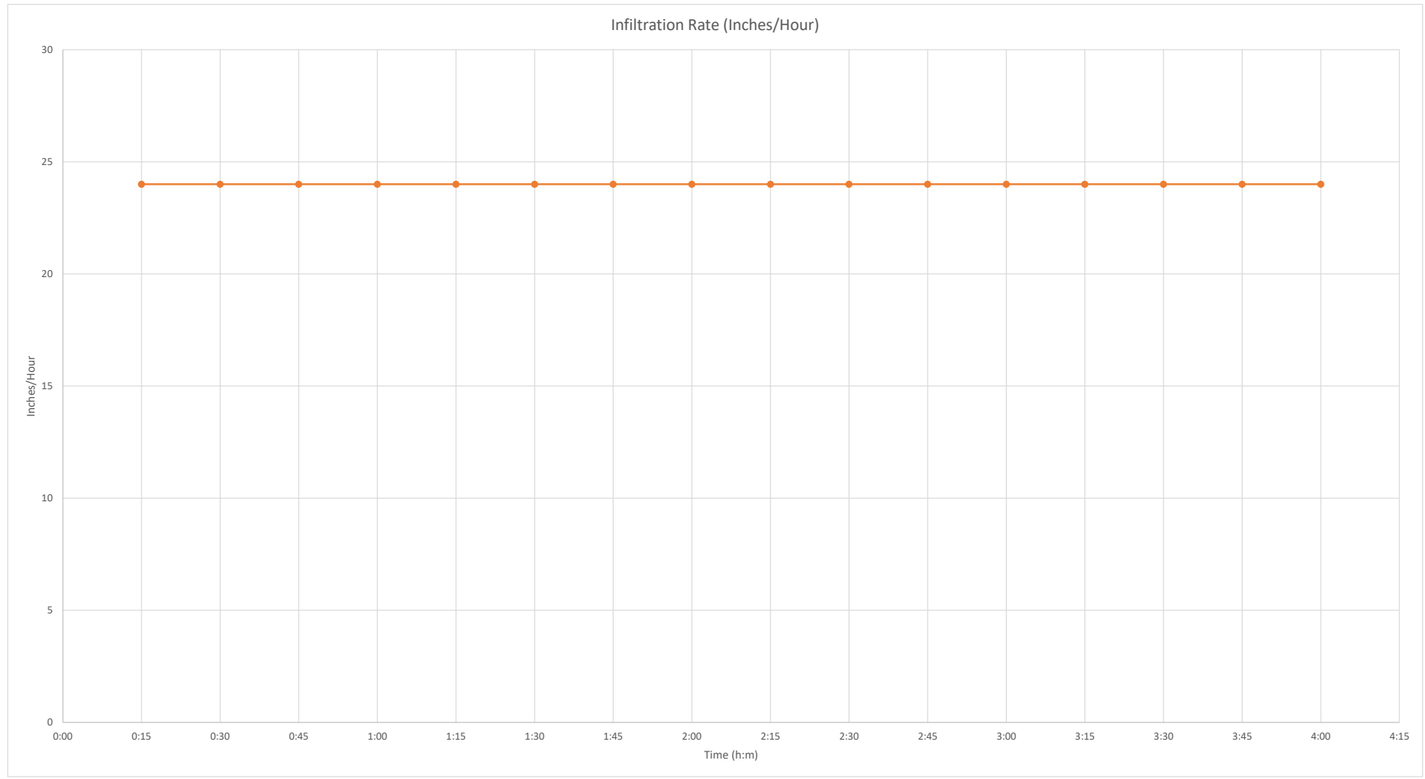
	3:00 PM	4:00		0.0	24.0	

Steady State Infiltration Rate 24.0





Arthur W. Perdue Stadium Upgrades
31240250

Location: SWM-2
Test Depth: 10.5

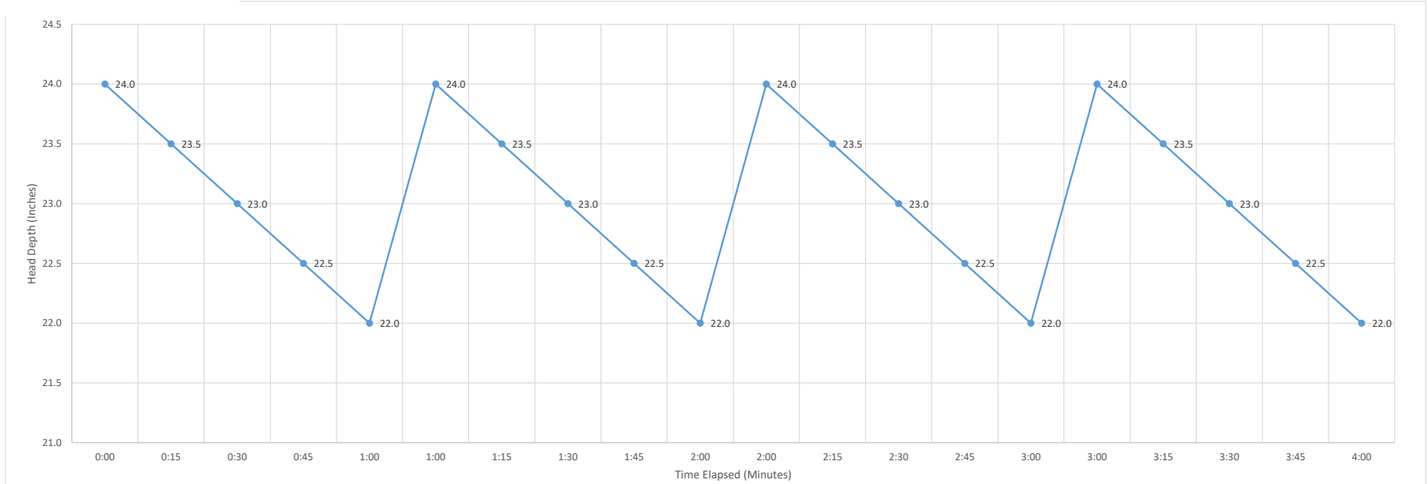
Single Ring Falling Head Infiltration Testing

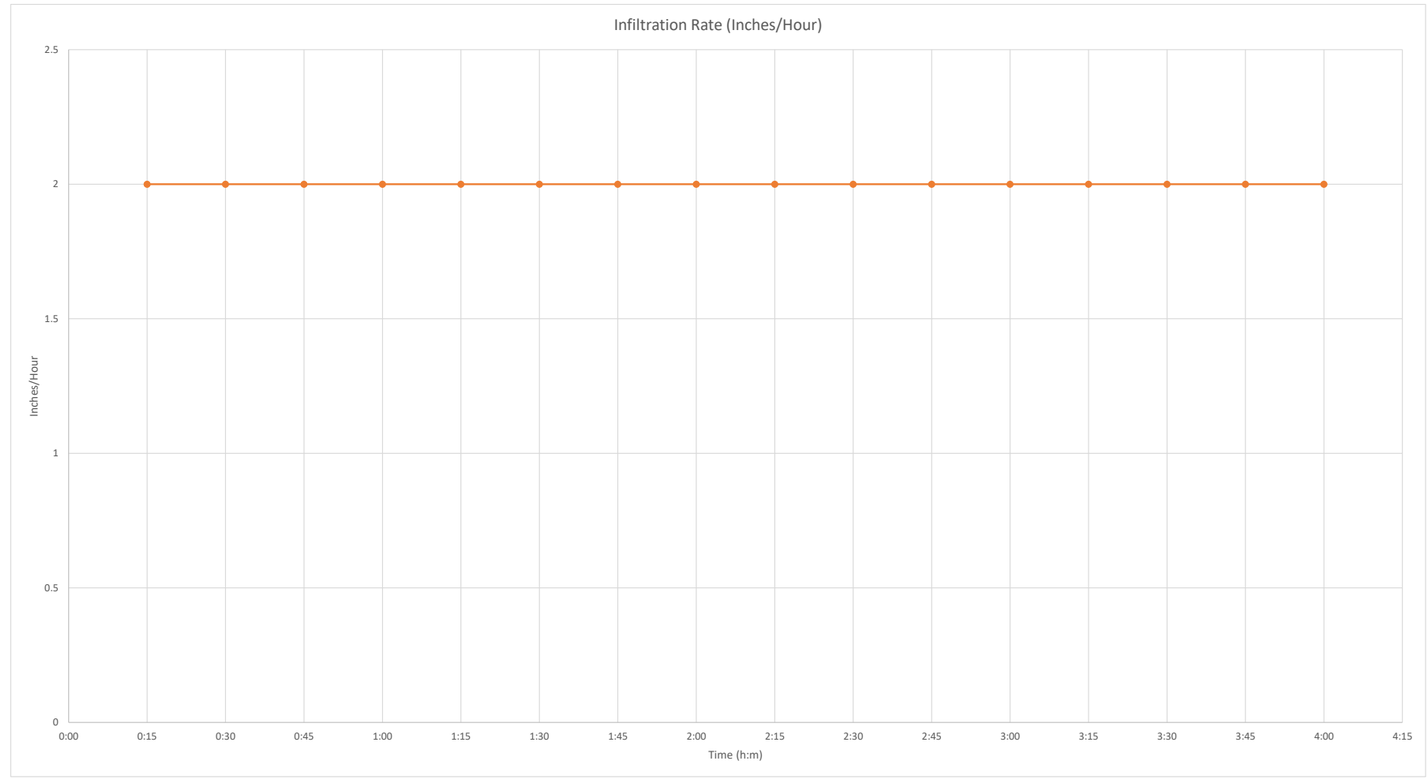
Name: Mitchell
I. D. of Pipe: 5 in.
Test Depth: 6.0 / 46.1 ft. / EL
Depth of Casing Penetration: 1"
Soil Type Tested: Sandy Loam

Date 3/20/2024
Temp _66°F_ Weather: Sunny
Rainfall Last 24 hrs. __0.0"___
Location: ___SWM-3_____
Presoak : 12" drop / 1+ hour

Date	Time	Δt (h:m)		Head of Water (in.)	Infiltration Rate (in/hr)	Comments
3/20/2024	11:00 AM	0:00		24.0		
	11:15 AM	0:15		23.5	2.0	
	11:30 AM	0:30		23.0	2.0	
	11:45 AM	0:45		22.5	2.0	
	12:00 PM	1:00		22.0	2.0	
	12:00 PM	1:00		24.0		
	12:15 PM	1:15		23.5	2.0	
	12:30 PM	1:30		23.0	2.0	
	12:45 PM	1:45		22.5	2.0	
	1:00 PM	2:00		22.0	2.0	
	1:00 PM	2:00		24.0		
	1:15 PM	2:15		23.5	2.0	
	1:30 PM	2:30		23.0	2.0	
	1:45 PM	2:45		22.5	2.0	
	2:00 PM	3:00		22.0	2.0	
	2:00 PM	3:00		24.0		
	2:15 PM	3:15		23.5	2.0	
	2:30 PM	3:30		23.0	2.0	
	2:45 PM	3:45		22.5	2.0	
	3:00 PM	4:00		22.0	2.0	

Steady State Infiltration Rate 2.0





Arthur W. Perdue Stadium Upgrades
31240250

Location: SWM-3
Test Depth: 6.0

APP

A A A A

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.1	16.3	69.9	13.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	99.9		
#16	99.5		
#30	94.0		
#40	83.6		
#50	65.1		
#100	29.0		
#200	13.7		

* (no specification provided)

Soil Description

Brown, Silty SAND

Atterberg Limits

PL= NP LL= NP PI= NP NM= 14.7

Coefficients

D_{90}= 0.5094 D_{85}= 0.4401 D_{60}= 0.2730
D_{50}= 0.2288 D_{30}= 0.1538 D_{15}= 0.0799
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: B-1 **Depth:** 4.0-6.0 feet
Sample Number: S-3

Date: 02/28/2024

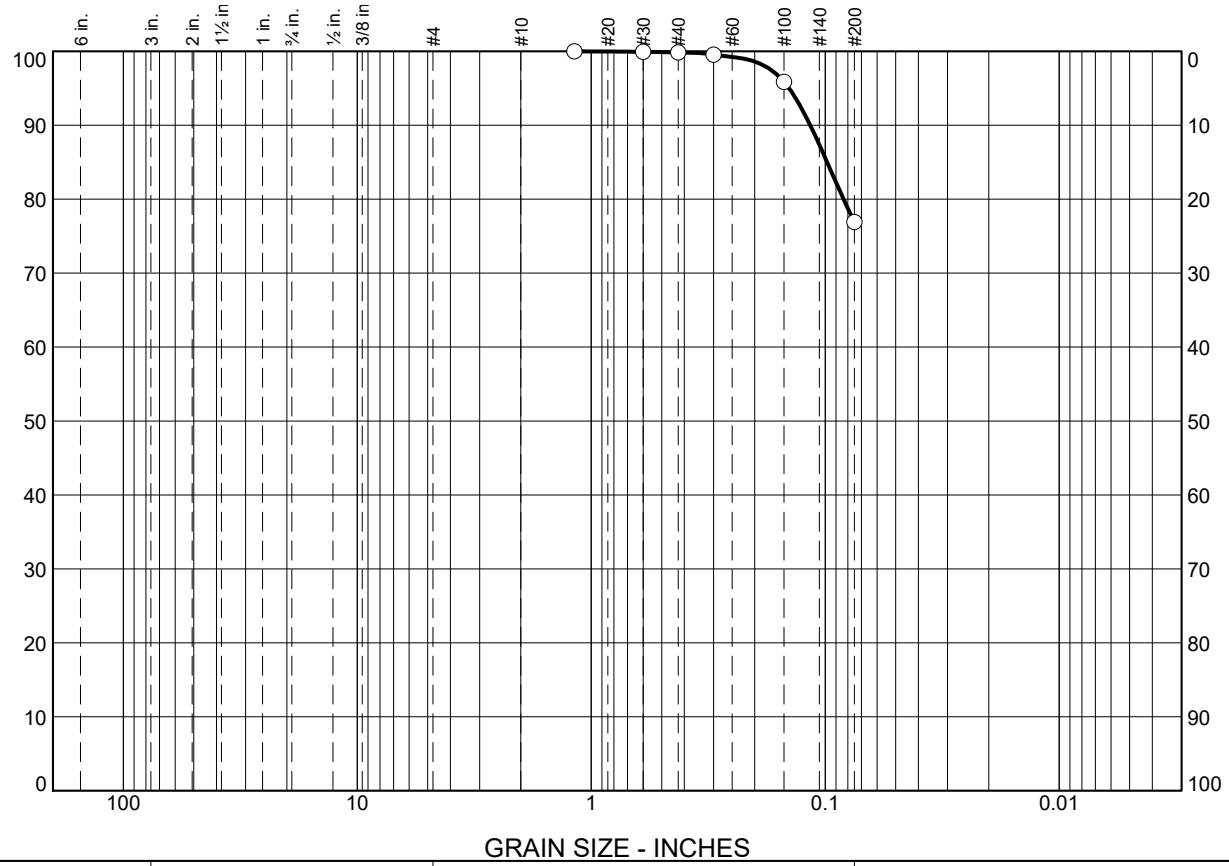
GEO-TECHNOLOGY ASSOCIATES, INC.
21133 Sterling Avenue, Suite 7
Georgetown, DE 19947

Client: McCrone Engineering
Project: Arthur W. Perdue Stadium Upgrades

Project No: 31240250 **Figure**

EwingCole
Project No. 20230573

Checked By: T. Caraway



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.0	0.2	22.9	76.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100.0		
#30	99.9		
#40	99.8		
#50	99.6		
#100	95.9		
#200	76.9		

* (no specification provided)

Soil Description

Gray, Silty CLAY with Sand

Atterberg Limits

PL= 17 LL= 23 PI= 6 NM= 18.5

Coefficients

D_{90}= 0.1159 D_{85}= 0.0981 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(2)

Remarks

Source of Sample: B-1 **Depth:** 18.5-20.0 feet
Sample Number: S-7

Date: 02/28/2024

GEO-TECHNOLOGY ASSOCIATES, INC.
21133 Sterling Avenue, Suite 7
Georgetown, DE 19947

Client: McCrone Engineering
Project: Arthur W. Perdue Stadium Upgrades

Project No: 31240250 **Figure**

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

EwingCole
Project No. 20230573

Checked By: T. Caraway

% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	7.5	22.9	0.3	16.1	44.1	9.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in	100.0		
1 in	97.6		
0.75 in	92.5		
0.5 in	74.8		
0.375 in	72.0		
#4	69.6		
#8	69.3		
#10	69.3		
#16	68.8		
#30	63.3		
#40	53.2		
#50	33.4		
#100	15.8		
#200	9.1		

* (no specification provided)

Soil Description

Brown, Well-graded SAND with Silt and Gravel

Atterberg Limits

PL= NP LL= NP PI= NP NM= 10.9

Coefficients

D_{90}= 17.8214 D_{85}= 16.0436 D_{60}= 0.5178
D_{50}= 0.3987 D_{30}= 0.2744 D_{15}= 0.1428
D_{10}= 0.0830 C_u= 6.24 C_c= 1.75

Classification

USCS= SW-SM AASHTO= A-3

Remarks

Source of Sample: B-3 **Depth:** 1.0-4.0 feet
Sample Number: S-02292024

Date: 02/28/2024

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

GEO-TECHNOLOGY ASSOCIATES, INC.
21133 Sterling Avenue, Suite 7
Georgetown, DE 19947

Client: McCrone Engineering
Project: Arthur W. Perdue Stadium Upgrades

Project No: 31240250 **Figure**

EwingCole
Project No. 20230573

Checked By: T. Caraway

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.1	20.9	68.5	10.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100.0		
#10	99.9		
#16	99.4		
#30	91.4		
#40	79.0		
#50	58.4		
#100	23.9		
#200	10.5		

* (no specification provided)

Soil Description

Brown, Poorly-graded SAND with Silt

Atterberg Limits

PL= NP LL= NP PI= NP NM= 14.6

Coefficients

D_{90}= 0.5688 D_{85}= 0.4892 D_{60}= 0.3087
D_{50}= 0.2577 D_{30}= 0.1750 D_{15}= 0.1003
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-3

Remarks

Source of Sample: B-4 **Depth:** 4.0-6.0 feet
Sample Number: S-3

Date: 02/28/2024

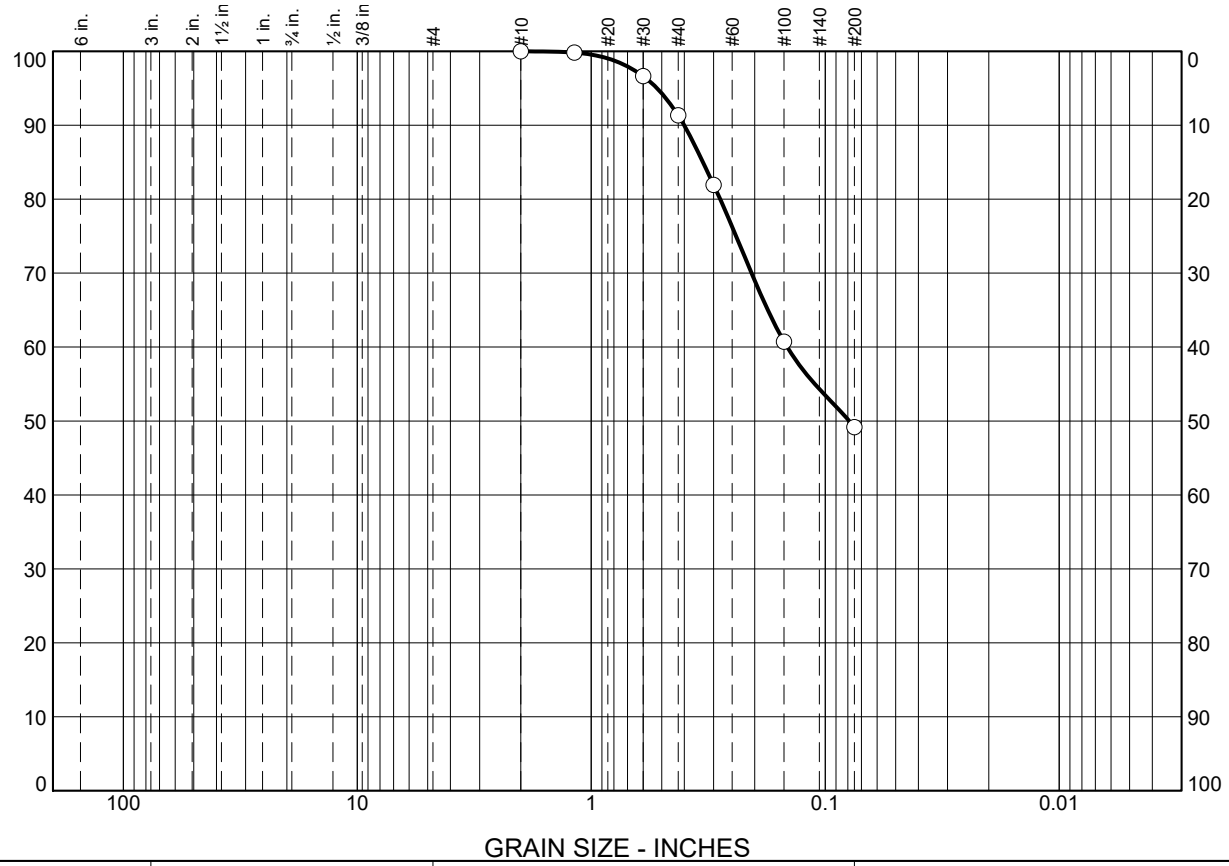
GEO-TECHNOLOGY ASSOCIATES, INC.
21133 Sterling Avenue, Suite 7
Georgetown, DE 19947

Client: McCrone Engineering
Project: Arthur W. Perdue Stadium Upgrades

Project No: 31240250 **Figure**

EwingCole
Project No. 20230573

Checked By: T. Caraway



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.0	8.6	42.2	49.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#16	99.8		
#30	96.6		
#40	91.4		
#50	81.9		
#100	60.7		
#200	49.2		

* (no specification provided)

Soil Description

Brown-gray, Silty, Clayey SAND

Atterberg Limits

PL= 16 LL= 22 PI= 6 NM= 16.0

Coefficients

D_{90}= 0.4004 D_{85}= 0.3332 D_{60}= 0.1454
D_{50}= 0.0789 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-4(0)

Remarks

Source of Sample: SWM-3 **Depth:** 10.0-12.0 feet
Sample Number: S-6 **Date:** 02/28/2024

GEO-TECHNOLOGY ASSOCIATES, INC.
21133 Sterling Avenue, Suite 7
Georgetown, DE 19947

Client: McCrone Engineering
Project: Arthur W. Perdue Stadium Upgrades

Project No: 31240250 **Figure**

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

EwingCole
Project No. 20230573

Checked By: T. Caraway

Project No.: 31240250 **Date:** 2/29/2024

Project: Arthur W. Perdue Stadium Upgrades

Client: McCrone Engineering

Source of Sample: B-3 **Depth:** 1.0-4.0 feet

Sample Number: S-02292024

Remarks:

MATERIAL DESCRIPTION

Description: Brown, Well-graded SAND with Silt and Gravel

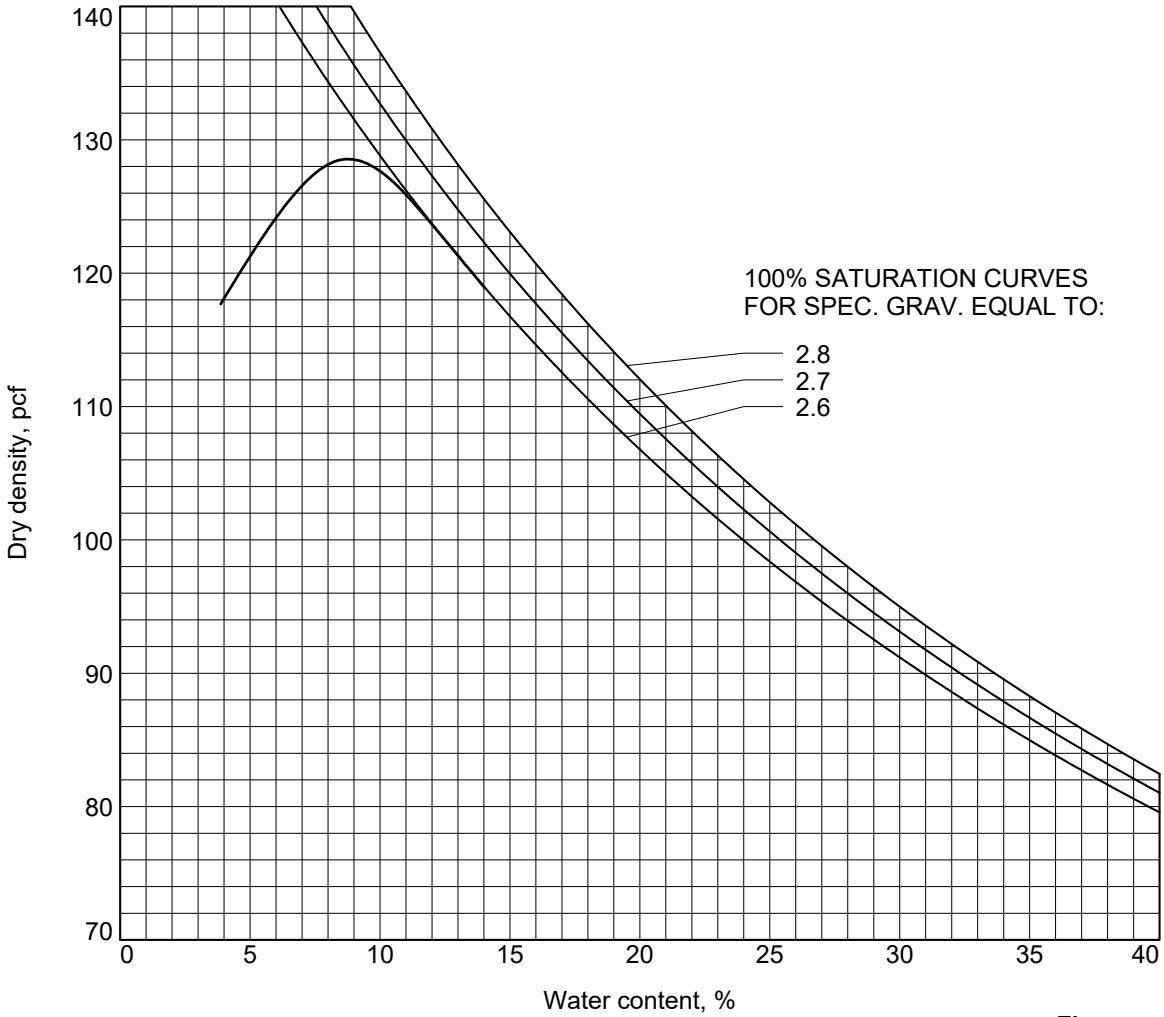
Classifications - **USCS:** SW-SM **AASHTO:** A-3

Nat. Moist. = 10.9 % **Sp.G. =** 2.6A

Liquid Limit = NP **Plasticity Index =** NP

% < No.200 = 9.1 %

TEST RESULTS
Maximum dry density = 128.6 pcf
Optimum moisture = 8.8 %



Figure

Geo-Technology Associates, Inc.

ASTM specifications performed may include C117, C136, D421, D422, D1140, D6913, D2216, D2217, and D4318

SECTION 024100

DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:

1. Vegetation to be protected.
2. Areas for temporary construction and field offices.
3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.

1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.

D. Demolition firm qualifications.

E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove concrete slabs on grade within construction limits indicated on drawings.

C. Remove fences and gates where indicated.

D. Remove other items indicated, for salvage, relocation, and recycling.

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Use of explosives is not permitted.

3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
4. Provide, erect, and maintain temporary barriers and security devices.
5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
8. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements to remain in place and not removed.

1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. Hazardous Materials:

1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

G. Perform demolition in a manner that maximizes salvage and recycling of materials.

1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.

1. Verify construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from areas that remain occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction indicated on drawings .

C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

D. Remove existing work as indicated and required to accomplish new work.

1. Remove items indicated on drawings.

E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.

1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.

1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove materials not to be reused on site; comply with requirements of Section 017419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including the following:

1. Cast-in-place concrete including mixture design, supplying, placing, consolidating, finishing, and curing.
2. Steel reinforcing complete with required supports, spacers, and related accessories.
3. Formwork and formwork design complete with required shoring, bracing, and anchorage.
4. Accessories including dovetail anchor slots, waterstops, reglets, expansion joint fillers, and preformed construction joints.
5. Vapor barriers.
6. Execution for items furnished under other sections, such as anchor rods, leveling plates, bearing plates, and embedded plates, precast concrete connections, anchors for attaching other materials, sleeves, and inserts.
7. Concrete repairs.
8. Certified surveys of concrete frame formwork, anchor bolts, mass timber bases and bearing plates.

B. Related Sections include the following:

1. Division 05 Section "Structural Steel Framing" for anchor rods and other items to be cast-in concrete.
2. Division 05 Section "Steel Decking".
3. Division 05 Section "Metal Fabrications".
4. Division 05 Section "Metal Stairs and Railings".
5. Division 07 Section "Joint Sealants".
6. Division 09 Sections for coordination with floor finish substrate requirements.
7. Division 09 Section "Mineral-Based Concrete Coating System"
8. Division 23, Mechanical items to be cast-in concrete; concrete foundations, and housekeeping pads for equipment.
9. Division 26, Electrical items to be cast-in concrete; concrete foundations, and housekeeping pads for equipment.
10. Division 31 Section "Earth Moving" for drainage fill under slabs on-grade.

1.3 REFERENCES

A. General.

1. Except where local building code is more stringent or where expressly stated differently in the Contract Documents, the following standards form a part of this Specification.

2. Keep copies of ACI publications at the job site at all times.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement or Portland-limestone cement alone or in combination with one of the following: blended hydraulic cement, fly ash, or ground granulated blast-furnace slag; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

A. Product Data and Material Certificates: For each type of product indicated. Include a letter signed by the manufacturer certifying that their product(s) meets the requirements of the Contract Documents and that all materials used in combination with other products produced by that manufacture or other manufactures are compatible with one another.

1. Cementitious materials.
2. Admixtures: Certification of compliance with the specified requirements, including, that admixtures do not contain calcium chloride or thyrocyanates and that admixtures are compatible with each other must be included in the mix design.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Curing compounds: In addition to certification of compliance with the Contract Documents submit written certification signed by the finish and adhesive/setting material manufacturer, that the proposed Curing Compound will not have a detrimental effect on the bond of the finish to the concrete or otherwise damage the finish.
7. Floor and slab treatments.
8. Bonding agents
9. Adhesives.
10. Vapor barriers.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

B. Design Mixes

1. For each concrete mixture proposed for use in the Project.
2. Alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
3. Complete and submit the "Concrete Mix Design Form" attached at the end of this section with each design mix. Provide copies to Architect and the Owner's Testing and Inspection Agency for review.
4. Design mixes shall be accompanied by each manufacturer's or producer's certification or test report indicating components of the mix comply with these specifications.
5. Design mixes shall be accompanied by historical laboratory compressive strength test data or trial mix data, demonstrating that the performances of the proposed mixes are in conformance with the requirements of this specification. All data submitted must comply with ACI 318.

C. Shop Drawings

1. Steel Reinforcement Shop Drawings.

a. Detail fabrication, bending, and placement. Indicate bar and wire fabric sizes, spacings, locations lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, stirrup spacing, tie spacing, mechanical connections, and supports for concrete reinforcement.
b. Wall elevations shall be drawn to a minimum scale of 1/4 inch=1 foot.
c. Cloud, bubble, or otherwise highlight and identify all revisions on the drawings. Submittals which do not identify changes and revisions will be returned as “Not Reviewed”. Do not renumber drawings that have already been submitted. Drawings that have been renumbered will be rejected. Refer to specification section 01 33 00 for more information.

2. Construction and Contraction Joints Shop Drawings: Drawings showing location of all construction, expansion, and contraction joints.

1.6 INFORMATIONAL SUBMITTALS

1. Product Data:

a. For recycled content, indicating postconsumer and preconsumer recycled content and cost.
b. Environmental product Declaration (EPD): For each concrete mix design.

2. Product Certificates: For materials manufactured within 100 miles of Project, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each raw material.
3. Laboratory Test Reports: For liquid floor treatments and curing and sealing compounds, indicating compliance with requirements for low-emitting materials.

B. Qualification Data.

1. Concrete Supplier.

a. Evidence that the plant has regular inspection of scales, gauges and other instruments at the maximum interval of 3 months for the past two years.
b. Copy of the Certificate of Conformance issued by the National Ready Mix Concrete Association (NRMCA) showing the plant currently meets the requirements of NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

2. Installer.

a. Certification that all personnel working on the Project are qualified according as ACI-certified Flatwork Technicians and Finishers and the Project Supervisor is an ACI-certified Flatwork Technician.

3. Testing agency's qualifications.

a. Testing agency shall be qualified in accordance with the requirements set forth in Specification Section 01 40 00 Quality Requirements.

C. Material Test Reports: For the following from a qualified testing agency indicating compliance with the requirements:

1. Aggregates, include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity (ASR).

D. Field Quality Control Reports

1. Surveys performed and certified by a registered Surveyor as follows:

   a. Floor surface flatness and levelness after concrete placement and with shores in place to verify compliance with specified tolerances.
   b. Anchor rods, leveling plates, base plates.

2. Field quality control testing and inspection reports.
3. Provide certification of ADA slip resistance compliance for all walking surfaces along with test data from an independent testing laboratory in accordance with ANSI A137.1 (B101.3/BOT-3000 test). Test shall be performed on the completed installed floor surface.

1.7 QUALITY ASSURANCE

A. Concrete Supplier Qualifications: A firm experienced in ready-mixed concrete that complies with ASTM C94/C94M requirements for production facilities and equipment. Supplier shall be certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C1077 and ASTM E329 for testing indicated, as documented according to ASTM E548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Preinstallation Conference: Conduct conference at Project site

1. Notify the Owner and Architect at least seven business days before the conference.
2. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
   e. Independent testing agency responsible for concrete field quality control.

3. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips,

semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-barrier installation, anchor rod, mass timber support, and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

4. Prepare and distribute official preinstallation conference minutes to all attendees and other appropriate parties.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Deliver reinforcement to job site bearing identification tag listing piece mark, size of bar and grade of steel.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 ADA COMPLIANCE

A. All exposed concrete slabs and floors shall be in accordance with OSHA requirements for slip resistance, COF of .6 for level; and .8 for ramped surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In another Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CEMENTITIOUS MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 miles of Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. General: Use cementitious materials, of the same type, brand, and source throughout the Project.

C. Cement

1. Portland Cement: ASTM C150, Type I, II, or I/II.
2. Portland Limestone Cement: ASTM C595, Type 1L.

D. Supplementary Cementitious Materials

1. Ground Granulated Blast Furnace Slag (GGBFS): ASTM C989, Grade 120.
2. Fly Ash: ASTM C618, Class F.

E. Blended Hydraulic Cement: ASTM C595, Type IS, portland blast-furnace slag; IP, portland-pozzolan; I (PM), pozzolan-modified portland, I (SM), slag-modified portland cement.

2.3 AGGREGATES

A. General: Store fine and coarse aggregates separately off ground on wooden platforms in such manner as to maintain segregation of size and avoid inclusion of dirt and other foreign materials.

B. Normal Weight Aggregate: ASTM C33, class 3S or better, well graded within prescribed limits. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Coarse aggregate size: Maximum 3/4 inch nominal.
2. Fine aggregate: Free of materials that will have a harmful reaction with the alkali in the cement.

2.4 WATER

A. ASTM C94/ C94M. Clean and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances. Water shall be potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260.

1. Available Manufacturers.

a. Euclid Chemical Company.
b. Grace Construction Products, W.R. Grace & Co.
c. Master Builders Solutions.
d. Sika Corporation.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride or thyrocyanates.

1. Available Manufacturers.

a. Euclid Chemical Company
b. Grace Construction Products, W.R. Grace & Co.
c. Master Builders Solutions
d. Sika Chemical Corporation

2. Water-Reducing Admixture: ASTM C494/C494M, Type A.
3. Retarding Admixture: ASTM C494/C494M, Type B.
4. Accelerating Admixture: ASTM C494/C494M, Type C. Long-term test data shall confirm admixture does not have a corrosive effect on metal deck and reinforcing steel.
5. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.

6. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
7. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
8. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
9. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Mix proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C192/C192M and tested in accordance with ASTM C39.

    a. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use on the project.
    b. Laboratory trial mixtures shall be proportioned with the maximum permitted slump and air content.

3. Prepare alternate design mixes when the characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

B. Cementitious Materials:

1. Cement replacement: Total cementitious material in all concrete mixes shall be comprised of portland cement and at least 20%, but not greater than 40%, ground granulated blast-furnace slag, by weight.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement at all exterior concrete elements and to 0.06 at all interior concrete elements.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete.
2. Use high range water-reducing admixture in pumped concrete, architectural concrete, concrete for heavy-use industrial slabs, parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
3. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

E. Slump Limit: 4 inches, 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

2.7 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Interior Footings and Pedestals (Not exposed to freeze/thaw conditions): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Structural drawings.
2. Maximum Water-Cementitious Materials Ratio: As indicated on the Structural drawings.
3. Air Content: As indicated on the Structural drawings.

B. Exterior Footings and Pedestals (Exposed to freeze/thaw conditions): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Structural drawings.
2. Maximum Water-Cementitious Materials Ratio: As indicated on the Structural drawings.
3. Air Content: As indicated on the Structural drawings.

C. Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Structural drawings.
2. Maximum Water-Cementitious Materials Ratio: As indicated on the Structural drawings.
3. Air Content: As indicated on the Structural drawings.

D. Interior Slabs-on-Grade (Not exposed to freeze/thaw conditions): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Structural drawings.
2. Air Content: : As indicated on the Structural drawings.

E. Exterior Slabs-on-Grade (Exposed to freeze/thaw conditions): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: As indicated on the Structural drawings.
2. Maximum Water-Cementitious Materials Ratio: As indicated on the Structural drawings.
3. Air Content: As indicated on the Structural drawings.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and furnish batch ticket information.

1. When air temperature is between 85 and 90° F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90° F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.9 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

C. Plain-Steel Welded Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 REINFORCING ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Diamond or Plate Dowels: ASTM A36 steel plate

C. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, ASTM A775/A775M epoxy coated.

D. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. Bar supports shall be manufactured from at least 80% recycled material.

F. Mechanical Splices: Positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements. Develop in tension or compression, as required, at least 125 percent of specified yield strength F_y of the bar.

2.12 FORM MATERIALS

A. Smooth Formed Finish: Panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for use as concrete forms, complying with DOC PS 1, minimum 5/8 inch thick and as follows:

   a. High-density overlay, Class 1 or better.
   b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
   c. Structural 1, B-B or better; mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

2. Metal.

B. Rough-Formed Finish: Plywood, lumber, metal, or another approved material suitable for use as concrete forms.

C. Forms for Cylindrical Members: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Formulate form-release agent with rust inhibitor for steel form-facing materials.

1. Available Products.

a. Euclid Chemical Company;, Formshield Pure or Formshield WB.
b. Nox-Crete Company; Nox-Crete or Nox-Crete PCE

I. Form Ties: Metal or glass-fiber-reinforced plastic adjustable in length, free of devices that will leave a hole or depression larger than 1 inch in diameter on exposed surface of concrete, and such that when forms are removed, no metal shall be within 1 inch of finished surface. Appearance as acceptable to Architect.

2.13 EXPANSION JOINTS

A. Expansion joint filler strips at interior and exterior joints shall consist of preformed strips of a durable, elastic sponge rubber compound, using synthetic rubber or natural rubber as a base and containing no reclaim rubber. Filler strips shall be gray in color and shall conform to requirements of ASTM D1752, Type I.

B. Filler strips shall be of sizes indicated.

2.14 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Available Products.

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.

2.15 VAPOR RETARDERS

A. Plastic Vapor Barrier: ASTM E1745, Class A, not less than 15 mil thick with permeance of less than 0.01 perms. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Available Products.

a. Viaflex; Vapor Block 15
b. Reef Industries, Inc.; Griffolyn 15 Mil Green
c. Stego Industries, LLC; Stego Wrap, 15 Mil
d. Poly-America, L.P.; Husky Yellow Guard, 15 Mil
e. GCP Advanced Technologies Construction Products; Florprufe® 120 Membrane

2.16 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Available Products.

a. Conspec by Dayton Superior Company; Aquafilm
b. Master Builders Solutions; MasterKure ER50
c. Euclid Chemical Company; Eucobar
d. Sika Corporation, Inc.; SikaFilm

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

1. Available Products.

a. Conspec Marketing by Dayton Superior; W.B. Resin Cure
b. Euclid Chemical Company; Kurez DR VOX

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating, and certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Available Products.

a. Conspec by Dayton Superior; Cure and Seal WB
b. Master Builders Solutions; Masterkure 200W
c. Euclid Chemical Company; Kurez W VOX

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

1. Products.

a. Conspec by Dayton Superior; Sealcure 1315 WB
b. Master Builders Solutions; MasterKure 1315 WB
c. Euclid Chemical Company; Super Diamond Clear VOX

2.17 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.0217 inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Nonshrink Grout (premixed)

1. Minimum compressive strength of 6,000 psi at 28 days.
2. Nonmetallic, Shrinkage-Resistant Grout: For general use. ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

a. Available Products.

1) Euclid Chemical Co.; NS or Hi-Flow Grout
2) Master Builders Solutions; MasterFlow 713.

C. Adhesive, Post installed anchors and reinforcing dowels: Epoxy as manufactured by Hilti, Inc. Type of epoxy and method of application shall be as recommended by the manufacturer and reviewed by the Architect.

D. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0396 inch thick, with bent tab anchors. Anchor slots must be compatible with anchors specified elsewhere. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.18 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.

B. Repair Topping: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than **5000 psi** at 28 days when tested according to ASTM C109/C109M.

C. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling

and placing. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color.

1. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

PART 3 - EXECUTION

3.1 GENERAL

A. Install concrete work in accordance with ACI 301 except as amended by this Section.

3.2 FIELD QUALITY CONTROL

A. General:

1. Owner will engage a special inspector and qualified Testing and Inspecting Agency to perform field tests and inspections and prepare test reports.
2. Cooperate with Testing and Inspection Agency in supplying materials and means of access to permit testing and inspection of concrete work
3. Provide an adequate storage box with a minimum/maximum reading thermometer for initial field curing of concrete specimens.
4. Notify Inspection and Testing Agency a minimum of 48 hours in advance of the work being completed and ready for the required tests and inspections.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Formwork for compliance with formwork design drawings and procedures.
5. Sampling and testing of fresh concrete.
6. Concrete placement, including conveying and depositing.
7. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F. and below and when 80 deg F. and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M. Cast five sets of two standard cylinders for each composite sample.

a. Laboratory cure three sets of two standard cylinder specimens.
b. Field cure two sets of two standard cylinder specimens.

1) Remove test specimens from molds at end of 24 hours and store in structure as near point of placement as possible; maintain conditions similar to those portions of structure that they represent.
2) Do not remove from structure for transmittal to laboratory prior to expiration of three-fourths of proposed period before removal of forms.

6. Compressive-Strength Tests: ASTM C39/C39M

a. Test laboratory-cured specimens as follows:

1) One set of two specimens at 7 days.
2) One set of two specimens at 28 days.
3) Hold one set of two specimens in reserve. Test when directed by the Architect.

b. Test field-cured specimens as follows:

1) One set of two specimens at an age determined by the Contractor for form stripping, but not later than 7 days.
2) One set of two specimens at 28 days.

c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete as directed by Architect when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met; and when Work is repaired or replaced. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect. Additional testing and inspecting shall be performed at the Contractor's expense.
12. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Surveys: Obtain surveys prepared by a Surveyor registered in the State of Maryland.

1. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing.
2. Upon completion of setting anchor rods, leveling plates, base plates, and mass timber bases determine the following:

    a. Location and elevation of anchor rods.
    b. Levelness and elevation of leveling plates.
    c. Location, levelness, and elevation of bearing plates.

3.3 FORMWORK

A. Design

1. Formwork design shall be prepared by or under the supervision of a qualified Professional Engineer.
2. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construction

1. Construct forms, complete with centering, cores and molds, to conform to shape, form, line and grade required, and to maintain sufficiently rigid to prevent deformation under load, within tolerances specified in ACI 117.
2. Construct forms tight enough to prevent loss of concrete mortar. The bottoms of forms shall be tight against previously placed, hardened concrete.
3. Coat bolts and nuts used for temporary internal ties with grease and arrange so that when forms are removed metal will be not less than 1 inch from any concrete surface. The design of form ties shall be subject to review by the Architect.
4. Chamfer exterior corners and edges of permanently exposed concrete.
5. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
6. Use individual sills for shores supported on grade or fill to allow individual adjusting.
7. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
8. Install keyways, reglets, recesses, and the like, for easy removal.
9. Do not use rust-stained steel form-facing material.
10. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
11. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
12. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
13. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
14. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.4 REMOVING AND REUSING FORMS

A. Remove forms in a manner to ensure complete safety of the structure under the direction of the formwork design Engineer employed by Contractor.

B. Formwork for sides of walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F. for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

C. In no case shall supporting forms or shoring be removed until members have acquired sufficient strength to support safely their weight and load thereon, including construction and shoring loads. Exercise care to ensure that structure is not subjected to heavy construction or material loading.

D. Loosen tie-rod clamps that are to be entirely removed from wall 24 hours after concrete pour.

E. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Withdraw nails from lumber once used in forms. Apply new form-release agent.

F. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

G. Except in freezing weather, wet forms with water in advance of placing concrete so that joints will tighten to prevent seepage of cement grout from mix.

3.5 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Minimum concrete cover over reinforcing shall be as indicated, but not less than the requirements of ACI 318.

C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

D. Reinforcement reduced in section shall not be used.

E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain true alignment and minimum concrete cover. Do not tack weld crossing reinforcing bars.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Place additional reinforcing around all openings with an area greater than one square foot as indicated on the Drawings.

H. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets to provide a full tension splice conforming to ACI 318. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

I. Lap splice reinforcing bars as indicated and in accordance with ACI 318.

J. Welding of reinforcing bars is not permitted unless specifically indicated on the Drawings. Where required, welded reinforcing shall conform to ASTM A706 and welding shall be performed in accordance with AWS D1.4.

K. If reinforcement is not shown, provide as shown in similar cases, but not less than #4 @ 12 inches each way in each face or minimum temperature steel in accordance with ACI 318, whichever is greater.

L. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

3.6 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded so they are straight, level, and plumb.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.7 VAPOR BARRIERS

A. Plastic Vapor Barriers: Place, protect, and repair vapor barriers according to ASTM E1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.
2. Turn film up vertical surfaces a distance equal to the slab thickness. Tape edges of vapor barrier continuously to foundation walls.
3. Tape seal penetrations through vapor barriers.

3.8 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Do not displace reinforcing. Install in longest lengths practicable.

3.9 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Expansion and Isolation Joints in Slabs-on-Grade

1. Install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

a. Joints shall be 1/2 inch wide, unless otherwise shown on the Drawings.

2. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
3. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section Joint Sealants, are indicated.
4. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
5. Finish edges of concrete slabs along joints neatly with a slightly rounded edging tool.
6. In no case shall reinforcement, corner protection angles, or other fixed items embedded in or bonded to concrete, be continuous through an expansion or isolation joint.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Coordinate location of slab-on-grade contraction joints with the location of joints in the floor finish.
2. The maximum dimension of a slab-on-grade panel without contraction joints shall be 15 feet in each direction.
3. Contraction joints shall be installed, grooved or saw cut, within 12 hours after the pour is completed

    a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
    b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
2. Coordinate location of slab-on-grade construction joints with the location of joints in the floor finish.
3. Locate construction joints in exposed concrete as indicated and approved by Architect.
4. Form keyed joints as indicated. Unless noted otherwise, embed keys at least 1-1/2 inches into concrete.
5. Locate joints for continuous foundations, grade beams, framed beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
6. Locate horizontal joints in walls and columns at underside of deepest, slab, beam, or girder framing thereto and at the top of footings or floor slabs.
7. Space vertical joints in walls no greater than 40 feet apart. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
8. Each concrete placement for slab-on-grade shall not exceed 8,000 sq. ft. with a maximum distance between construction joints of 90 feet. Allow a minimum of 48 hours between adjacent concrete placements.
9. Fill all joints with sealant.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.10 PREPARATION FOR PLACING CONCRETE

A. Remove water from excavations before depositing concrete. Divert flow of water through proper side drains without washing over freshly deposited concrete.

B. Remove hardened concrete, debris and foreign matter from interior of forms and from inner surfaces of mixing and conveying equipment.

C. Ensure forms, reinforcement, and joints are not disturbed during concrete placement.

D. Use clean compressed air to remove foreign matter from the forms.

E. Remove freestanding water, ice and snow from within forms.

F. Provide runways, or other means for wheeled equipment or convey the concrete to point of deposit.

1. Do not wheel equipment used to deposit concrete over reinforcement.
2. Do not support runways on reinforcement.

G. Do not use deicing salts.

H. Before depositing new concrete on or against concrete that has set, thoroughly roughen and clean existing surfaces free of laitance, foreign matter, and loose particles. Retighten forms. Apply a bonding agent to the existing concrete in accordance with manufacturer's recommendations.

I. In locations where new concrete is doweled to existing concrete, drill holes in existing concrete, insert steel dowels into epoxy adhesive.

J. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

3.11 PLACING CONCRETE

A. Do not add water to concrete during delivery, after adding high-range water-reducing admixtures, at Project site, or during placement.

B. Place concrete in the forms within the time limits specified in Part 2, Concrete Mixing.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated.

1. Deposit concrete to avoid segregation.
2. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
3. Do not splash forms or reinforcement of adjacent areas with concrete at the time of pouring. Deposit concrete in forms as nearly as practicable in final position.
4. Where pumping of concrete is employed for placement, provide the proper size equipment for the operation, including any backup equipment.

D. Free fall shall not exceed 10 feet for concrete containing the High Range Water Reducing Admixture or 5 feet for other concrete, unless noted otherwise. Not more than 8 feet and 3 feet

respectively for exposed concrete work. Where greater drops are required, employ a trunk, tremie or other means in accordance with ACI standards to reduce the free fall.

E. Consolidate placed concrete with internal mechanical vibrating equipment according to ACI 301.

1. Do not use form vibrators.
2. Maintain at least one spare vibrator as a relief.
3. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in concrete.
4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Allow at least 24 hours to elapse between beginning concrete placement in vertical elements and placing concrete for members supported thereon.

H. Allow at least 48 hours to elapse between beginning concrete placements for adjacent sections of horizontal Work.

I. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40° F. for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

J. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90° F. at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

K. Earth Supported Concrete

1. Place concrete directly supported by earth upon clean, undisturbed subgrade, free from standing water, mud, frost, or ice.
2. Do not place concrete until all pipes under proposed slabs and structural members have received the required testing and been accepted.

3.12 FORMED FINISHES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.13 FLOOR FINISHES

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces or dust with dry cement.

1. Coordinate concrete floor / slab finishing with Div-09 floor finish substrate requirements.

B. Type 1 Finish (Trowel Finish): After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces to be covered with finish flooring.
2. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

C. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

E. Exterior Sidewalk and ramps: Begin the second floating operation when bleed-water sheen has disappeared, and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Course-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to traffic.

3.14 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1 for at least 7 days while maintaining the concrete at a temperature of at least 50 deg F. by one or a combination of the following methods. The method and material must be compatible with and not be detrimental to the bond of any subsequently applied finish.

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days.

Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.15 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor rods for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.16 JOINT FILLING

A. Prepare, clean, and install joint sealant according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.17 CONCRETE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect at no additional cost to the Owner. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Undercut exposed reinforcing at least 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean and saturate surface with water, remove excess standing water, and scrub in a brush-coat patching mortar. Fill and compact with patching mortar before brush coat has dried. Strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

C. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

D. Perform structural repairs of concrete, subject to Architect's approval.

E. Repair materials and installation not specified above may be used, subject to Architect's approval.

CAST-IN-PLACE CONCRETE MIX DESIGN SUBMITTAL FORM

Submit separate form for each mix design.

Project Name: _____ Date: _____
Mix Design No.:_____ Conc Strength, F'c: _____ psi
Air Entrained: ☐YES ☐NO High Range Water Reducer: ☐ YES ☐NO
Concrete use (describe):_____

Client: _____
Address/Phone No.: _____
_____

General Contractor:_____
Address/Phone No.: _____
_____

Concrete Contractor: _____
Address/Phone No.: _____
_____

Concrete Supplier: _____
Address/Phone No.: _____
_____
Plant Location: _____
Number of miles to site: _____
Estimated time to site:_____

Conc. Wet Unit Wt.:_____ lb/cu. ft. Conc. Dry Unit Wt.: _____ lb/cu. ft.
W/C Ratio:_____ % Cement Replaced:_____
Air Content: _____
Slump before addition of high range water reducer:_____ in.
Slump after addition of high range water reducer: _____ in.

Materials	Weight per cu. yd.	Specific Gravity lb/cu. ft.	Source	Remarks
Cement				
Cement Replacement (list type)				
Fine Aggregate				
Coarse Aggregate				
Fibers				
Water				

Admixture	ASTM Reference	Dosage oz/100 lbs	Product	Manufacturer
Air Entraining	C260			
Water Reducing	C494, Type A			
Retarding	C494, Type B			
Accelerating	C494, Type C			
High Range Water Reducing	C494, Type F			

Manufacturer of each admixture to submit written certification letter stating that the admixture meets the required ASTM, contains no calcium chloride or thyrocyanates and that the admixtures are compatible with each other.

STRENGTH VERIFICATION

Method Used to Document Average Compressive Strength
Field Experience: ☐ (*check if historical data is used to document average strength)*
Trail Mixtures: ☐ (*check if laboratory trial mixes are used to document average strength)*

Historical Test Data Standard Deviation Analysis
Number of Test Cylinders Evaluated: _____ Standard Deviation: _____
Required Average Compressive Strength, F'cr: _____ psi
28 Day Average Laboratory Cured Cylinder Compressive Strength: _____ psi

Trial Mix Laboratory Compressive Strength Test Data
Required Average Compressive Strength, F'cr: _____ psi

	Laboratory Cured Cylinder Compressive Strength - psi		
	Mix 1	Mix 2	Mix 3
W/C			
7 days			
7 days			
7 days			
7 days (avg.)			
28 days			
28 days			
28 days			
28 days (avg.)			

END OF SECTION

SECTION 035400

CAST UNDERLAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Instructions.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.5 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cementitious Underlayment:

1. ARDEX Engineered Cements
2. Custom Building Products
3. LATICRETE International, Inc.

4. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Cast Underlayments, General:

1. Comply with applicable code for combustibility or flame spread requirements.
2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 4000 pounds per square inch after 28 days, tested per ASTM C109/C109M.
2. Flexural Strength: Minimum 1000 psi after 28 days, tested per ASTM C348.
3. Density: 125 pounds per cubic foot, nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.

B. Concrete: Prepare surfaces according to ICRI 310.2R.

C. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

D. Vacuum clean surfaces.

E. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

F. Close floor openings.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.

C. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 042000

UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Lintels.

F. Accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

F. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

1.3 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.4 MOCK-UPS

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, and structural backup in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of work.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
2. Load-Bearing Units: ASTM C90, normal weight.
   a. Exposed Faces: Manufacturer's standard color and texture where indicated.
3. Nonloadbearing Units: ASTM C129.
   a. Both hollow and solid block.
   b. Normal weight.
4. Split-Faced Units: ASTM C90, hollow block.
   a. Colors and styles: As selected by Architect.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color: To match Architect's sample when incorporated into specified mix design.

F. Water: Clean and potable.

G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Type S.
2. Color: Standard gray.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

2.4 FLASHINGS

A. Metal Flashing Materials: Stainless Steel, as specified in Section 076200.

2.5 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 LINTELS

A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification.

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout.

2.7 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, Type S.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

B. Remove excess mortar and mortar smears as work progresses.

C. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

3.7 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.8 LINTELS

A. Install precast concrete lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

C. Maintain minimum 8 inch bearing on each side of opening.

3.9 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.10 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Do not build into masonry construction organic materials that are subject to deterioration.

3.12 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

3.13 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 CLEANING

A. Clean soiled surfaces with cleaning solution.

3.15 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel members including**,** structural steel support members, metal deck support angles, struts, and all other material required for the proper installation of the structure, with required bracing, welds and fasteners.
2. Shop painting, galvanizing, and field touch-up.
3. Grout.

B. Related Sections include the following:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 05 Section "Steel Decking" for field installation of shear connectors.
3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
4. Division 06 Section "Structural Mass Timber Framing and Decking" for miscellaneous steel fabrications and other metal items associated with the mass timber framing.
5. Division 09 painting Sections for surface preparation and priming requirements.
6. Division 07 Sprayed Fire Resistive Materials for compatibility with fire proofing system.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections as outlined below:

1. Where connections are fully detailed on the contract documents, follow ANSI/AISC 303 Section 3.1.1, Option 1 and as follows:

a. Fully detailed connections are defined as connections that include the following information on the contract documents:

1) Weld types, sizes, lengths and strengths.

2) Bolt sizes, locations, quantities and grades.
3) Plate and angle sizes, thicknesses, dimensions and grades.
4) Work point locations and related information.

b. No deviation in connection type shall be made.

2. Where connections are not fully detailed on the contract documents, follow ANSI/AISC 303-16 Section 3.1.1, Options 3 and 3B and as follows:

a. Design and detail connections in accordance with the 15th Edition of ANSI/AISC 360-10 and the RCSC's "Specification for Structural Joints Using High-Strength Bolts".
b. Connections shall be designed by a licensed professional engineer working for the steel fabricator.
c. The following connection types shall be permitted for shear connections:

1) Double-angle connections – all bolted, bolted/welded, all welded.
2) Single-plate connections
3) Tee connections

d. Submit representative samples of substantiating connection information. Sample calculations will be reviewed for consistency with the requirements of the contract documents.
e. The licensed professional engineer in responsible charge of connection design shall review and confirm in writing as part of the substantiating connection submittal, that the shop and erection drawings have properly incorporated the connection design.
f. The fabricator shall provide a means by which the substantiating connection information is referenced to the related connections on the shop and erection drawings for timely submittal review.
g. All connections shall be designed for the combined effects of shear, moment, axial and torque at applicable locations.
h. All beam/girder connections to columns shall be full-depth double-angle shear connections unless noted otherwise on the contract documents.
i. All column splice connections in braced frames shall develop the full tension capacity of the column. Bolts shall be slip-critical.
j. Skewed beam to column connections shall be detailed to provide a full depth of beam connection.
k. Welds in shear connections shall be continuous.
l. All beam web shear connections shall be detailed so that the lengths of the connection plates or angles is not less than one-half of the "T" dimension of the support beam.
m. All forces, whether shear, moment, axial or transfer, shown on drawings are factored, based on load factored resistance design.
n. Moment connections shall be designed as fully restrained Type (FR) moment connections.
o. Beams framing to spandrel members (members supporting an edge of slab or deck condition) shall be connected to the spandrel member with a full-depth connection to eliminate torsional rotation of the spandrel member at the point of connection.
p. Drag connections shall be detailed and designed to transmit axial forces at the top flange of the member. Shear connections within a drag connection shall not be designed to transmit axial loads.

B. Construction: Lateral Force Resisting System, Type FR, fully restrained.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Indicate sizes, spacing and locations of structural members.
2. Include details of cuts, connections, splices, camber, shear studs, attachments, holes, and other pertinent data.
3. Include embedment drawings.
4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Indicate all AWS weld designations for pre-qualified full and partial penetration welds and detail all joint preparations.
5. Provide erection details of all field welded connections.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
7. Detail material required for the connection of other work such as precast plank, metal deck, exterior building skin, etc.
8. Clearly indicate the connection capacity of non-standard connections on the shop drawing piece detail for the Architect's review and approval.
9. Use of the Architect's drawings as erection plans and details is not permitted. It is mandatory that the fabricator/detailer independently prepare erection drawings. Electronic files will not be provided by the Architect.
10. Cloud, bubble, or otherwise highlight and identify all revisions on the drawings. Submittals which do not identify changes and revisions will be returned as "Not Reviewed". Drawings that have been renumbered shall be treated as first submissions and Architects review may constitute additional services. Refer to specification Section 01 33 00 for more information.

C. Field Work Shop Drawings: Prepare location specific information illustrating the proposed field modification of structural-steel components when field conditions do not permit installation as fabricated. Submit proposed modification and received written approval prior to performing the field modification. Field work shop drawings shall clearly reference the latest related shop drawings. For additional requirements, refer to "Shop Drawings" above.

1.6 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration (EPD): when available from product manufacturer, provide for each product.

B. Design Data for Delegated Design Connections: Prepare and submit structural design calculations for connections meeting the specified requirements. Calculations shall be signed and sealed by the Contractor's Professional Structural Engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For fabricator**,** erector and professional engineer**.**

1. Provide evidence that the structural steel fabricator has a minimum of five (5) years of experience in designing, detailing and fabricating projects constructed in the USA.

2. Provide evidence that the structural steel erector has a minimum of five (5) years of experience in the installation of structural steel for similar projects constructed in the USA.

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.

F. Quality-control test reports – field and shop.

G. Wide flange shapes with flange thickness exceeding 2 inches shall be supplied with Charpy V-Notch (CVN) impact test results in accordance with ASTM A6/A6M, Supplementary Requirement S30, Charpy V-Notch Impact Test for Structural Shapes – Alternate Core Location. The impact test shall meet a minimum average value of 20 ft-lbs absorbed energy at +70° F.

1.7 RECORD SUBMITTALS

A. Record Product Data: Submit a comprehensive set of all products relevant to the project. Include the “as fabricated/manufactured” condition of the product that is described. Additionally, include any modifications that were made in the field, showing the “as installed/erected” condition of the product that is described.

B. Record Shop Drawings: Submit a comprehensive set of erection, piece and field work record shop drawings. Include the “as fabricated/manufactured” condition of the structural steel component that is detailed on the shop drawing. Additionally, include any modifications that were made in the field, showing the “as installed/erected” condition of the component that is detailed on the shop drawing.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges" ANSI/AISC 303-16.
2. AISC's " Specification for Structural Steel Buildings" ANSI/AISC360-16.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.11 UNIT PRICES

A. Unless specified otherwise by the Construction Manager, provide unit prices in accordance with the following:

1. Provide unit prices for additions to and deductions from the contract.
2. Unit prices shall include all labor and material required for the complete installation of structural steel work, including detailing, shop drawings preparation and revisions, ordering materials, engineering, fabrication, delivery, erection and painting.
3. Provide unit prices for two (2) classifications of steel, which shall be interpreted to cover all categories of structural steel required for this project:

a. Classification 1 – Main Steel Framing: This shall include columns, posts, beams, girders, trusses and connections. It shall also include base plates, bearing plates, stiffeners, angles, etc., which become part of the framing.
b. Classification 2 – Light Steel Framing: This shall include subframing for smaller mechanical and electrical openings, spandrel angles, bent plates, light angle or channel frames for various purposes, and framing of a similar nature that may be required for the construction of the project. It shall also include channels and light beams 8 inch and smaller, angles smaller than 4 inches x 4 inches and tubular sections.

1.12 STEEL CONTINGENCY ALLOWANCE

A. Include in base bid a Steel Contingency Allowance for changes to steel contract by utilizing unit prices for Classification 1 and 2, as defined in UNIT PRICES paragraph, in the amount of 1.5 tons for Classification 1 and 1 tons for Classification 2. Identify Steel Contingency Allowance amount in bid proposal. Additions and deductions to steel contract documented after award shall be tracked according to unit prices and classifications of steel defined in UNIT PRICES paragraph. Contractor shall only be entitled to payment for changes to steel contract that are approved by the Owner. Any remaining balance within the Steel Contingency Allowance shall be credited to the Owner at contract completion.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles, Shapes: ASTM A572/A572M, Grade 50.

C. Base Plates, Splice Plates, Cap Plates, Moment Plates and Web Plates: ASTM A572/A572M, Grade 50.

D. Connection Plates and Bar: ASTM A572/A572M, Grade 50.

E. Corrosion-Resisting Structural Steel: ASTM A588/A588M, Grade 50.

F. Cold-Formed Hollow Structural Sections: ASTM A500, Grade C, structural tubing.

G. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

1. Weight Class: Standard.
2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Plain. Hot-dip zinc coating, ASTM A153/A153M, Class C where galvanized members are connected.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, round head steel structural bolts with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Plain**.** where galvanized members are connected.

C. Shear Connectors: ASTM A108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Unheaded Anchor Rods: ASTM F1554, Grade 55, weldable, as indicated on the drawings.

1. Configuration: As indicated on the Structural drawings.
2. Nuts: ASTM A563 heavy hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436 hardened carbon steel.
5. Finish: Plain unless noted otherwise**.** Hot-dip zinc coating, ASTM A153/A153M, Class C where galvanized members are connected.

E. Threaded Rods: ASTM A572/A572M, Grade 50.

1. Nuts: ASTM A563 heavy hex carbon steel.

2. Washers: ASTM F436 hardened carbon steel.
3. Finish: Plain unless noted otherwise. Hot-dip zinc coating, ASTM A153/A153M, Class C where galvanized members are connected.

2.3 PRIMER

A. Fabricator's standard lead-and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer:

1. Acceptable Product: Subject to compliance with requirements, provide the following:

   a. SW Pro Industrial Pro-Cryl Universal Primer
   b. BM Ultra Spec HP Acrylic Metal Primer HP04
   c. PPG Architectural Coatings Pitt-Tech Plus Exterior DTM Industrial Primer.

2. Etching Cleaner: MPI#25, for galvanized steel.
3. Galvanizing Repair Paint: ASTM A780/A780M.
4. Coordinate primer with finish coats. Provide products from a sole source single manufacturer.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, 5000 psi minimum compressive strength, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's Specification for Structural Steel Buildings."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A6/ A6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type:

a. Snug tightened at simple beam to girder infill framing connections, unless noted otherwise.
b. Pretensioned at all beam, girder and truss to column connections, unless noted otherwise.
c. Slip critical:

1) Where indicated on the drawings.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where structural steel is exposed to public view.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Conditions detailed as shop welds on the Drawings may be substituted with field welds at no additional cost to the Owner.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/ A123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize steel angles and bottom plates supporting masonry and where noted on Drawings.
3. Galvanize structural members for roof screen supports and mechanical equipment supports.

2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. 72-hour advance notice shall be provided by the Contractor in writing to the testing agency prior to commencement of shop welding that requires continuous inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High Strength Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following testing procedures, at testing agency's option:
1. Liquid Penetrant Testing: ASTM E165.
2. Magnetic Particle Testing: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Testing: ASTM E164.
4. Radiographic Testing: ASTM E94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports only after all final connections of structural steel and metal deck have been completed, and concrete slabs have been installed and achieved full design strength. The Contractor is responsible for the stability of the structure until these conditions have been met.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Specification for Structural Steel Buildings."

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.

1. Set base plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Remove erection bolts, seats and/or lifting pads on exposed structural steel; fill any open holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts only after approval by Architect.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

J. All shims or combinations of shims resulting in a thickness greater than 1/4 inch shall be welded to one another and to the base material. All shims required for steel framing adjacent to mass timber construction shall be provided hot dip galvanized.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type:

a. Snug tightened at simple beam to girder infill framing connections, unless noted otherwise.
b. Pretensioned at all beam, girder and truss to column connections, unless noted otherwise.
c. Slip critical:

1) Braced frame connections, including column splices.
2) Connection of truss members and splices.
3) Where indicated on the drawings.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth where structural steel is exposed to public view.
3. All field welds shall be a minimum of ¼ inch fillet welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to test and inspect field welds and high-strength bolted connections.

B. Bolted Connections: Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High Strength Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. 48-hour advance notice shall be provided by the Contractor in writing to the testing agency prior to commencement of field welding requiring continuous inspections.

2. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following testing procedures, at testing agency's option:

    a. Liquid Penetrant Testing: ASTM E165.
    b. Magnetic Particle Testing: ASTM E09; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Testing: ASTM E164.
    d. Radiographic Testing: ASTM E94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted members and accessories and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
3. Apply finish paint system.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists
2. KCS-type K-series steel joists
3. Joist accessories

1.3 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:

1. Roof Joists: Vertical deflection of 1/360 of the span

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.
2. Detail material required for the connection of other work such as precast plank, metal deck, exterior building skin, etc.
3. Use of the Architect's drawings as erection plans and details is not permitted. It is mandatory that the fabricator/detailer independently prepare erection drawings. Electronic files will not be provided by the Architect.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

C. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

D. Qualification Data: For manufacturer and professional engineer**.**

E. Field quality-control test and inspection reports.

F. Research/Evaluation Reports: For joists.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.9 SEQUENCING

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Steel Bearing Plates: ASTM A572.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated**.**

D. High-Strength Bolts, Nuts, and Washers: ASTM A25, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.

1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Serie" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, parallel top chord.

1. Joist Type: K-series steel joists and KCS-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Extended Ends: Extend bearing ends of joists with SJI’s Type R extended ends where indicated, complying with SJI’s “Specifications.”

D. Camber steel joists according to SJI's "Specifications."

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1.

C. Bolted connections will be visually inspected.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck
2. Accessories including fasteners, closures and sump pans
3. Bearing plates and angles

B. Related Sections include the following:

1. Division 01 Section “Quality Requirements” for independent testing agency procedures and administrative requirements
2. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors
3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes
4. Division 09 painting Sections for repair painting of primed deck

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, pans, cut deck openings and associated reinforcement, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of steel deck, signed by product manufacturer.

B. Welding certificates.

C. Qualification Data:

1. Provide evidence that the structural steel fabricator has a minimum of five (5) years of experience in designing, detailing and fabricating projects constructed in the USA.
2. Provide evidence that the structural steel erector has a minimum of five (5) years of experience in the installation of structural steel for similar projects constructed in the USA.

D. Field quality-control test and inspection reports.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Powder-actuated mechanical fasteners

F. Research/Evaluation Reports: For steel deck.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

B. Submit letter certifying that metal deck meets UL design certification number for fire ratings.

C. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:

a. ASC Profiles, Inc.
b. Nucor Corp.; Vulcraft Division
c. Roof Deck, Inc.
d. United Steel Deck, Inc.
e. Verco Manufacturing Co.

2.3 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A653, Structural Steel (SS), Grade 40 minimum, G90 zinc coating.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A653, Structural Steel (SS), Grade 40 minimum, G90 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

    a. Color: Manufacturer's standard.

3. Roof Deck Types

    a. 1 ½ inch galvanized metal roof deck, 20 gauge, Type B.

4. Span Condition: Double span or more.
5. Side Laps: Overlapped.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws. All fasteners shall be driven flush and at 90 degrees to the metal deck support substrate.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 20 gauge, of same material and finish as deck; of profile indicated or required for application.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Flat Sump Plate: Single-piece steel sheet, 14 gauge minimum, of same material and finish as deck. For drains, cut holes in the field.

H. Bearing Plates and Angles: ASTM A36 steel.

I. Galvanizing Repair Paint: ASTM A780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Take total responsibility to verify that the deck will support construction loads on the decking during and after installation.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work. Reinforce openings over 12 inches in size in accordance with structural framing details indicated on the drawings. Reinforce deck openings from 6 to 12 inches in size with 2x2x1/4 inch steel angles on each side of opening. Place angles perpendicular to flutes; extend minimum two flutes each side of opening and weld to deck.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions. Fasteners shall have equivalent or greater working capacity than ¾ inch diameter.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. For 1 ½ inch roof deck, use 36/5 fastening pattern in the field of roof and space welds 6 inches apart in roof perimeter and corners, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28 or 10’-0” measured from edge of roof, whichever is greater.

B. Side-Lap Fastening: Fasten side laps of panels between supports with self-drilling, No. 10 diameter or larger, carbon-steel screws, at intervals not exceeding 12 inches.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches on steel members with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install sump pans, 14 gauge minimum, over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Weld or fasten at each deck flute.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Ceilings, light fixtures, ducts or other utilities shall not be supported by roof deck.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements. Contractor shall be responsible for errors in fabrication and/or proper fitting of members shown on shop drawings.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

F. Replace units damaged during construction activity.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

C. Damaged and rough or unsightly work will be rejected by the Architect.

END OF SECTION

SECTION 05 31 50

METAL SUBROOF AND GUTTER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal subroof and gutters including design, furnishing, and installation of a metal decking subroof and gutter system, including, but not limited to, support hardware, support framing, gutters, pipings and miscellaneous flashings. Coordination with mechanical and electrical support systems penetrating or suspended from subroof.

B. Related Sections include the following:

1. Division 07 Section “Joint Sealants”

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at project site. Coordinate the work of all subcontractors that are performing adjacent work with the subcontractor for the subroof system to review and minimize the number of penetrations.

1.4 ACTION SUBMITTALS

A. Product data and calculations including manufacturer's specifications and installation instructions for each type of decking and accessories.

1. Provide test data for mechanical fasteners used for fastening deck to supporting structures.

B. Shop drawings showing layout and types of deck units, sections of work to be factory finish painted, anchorage details, flashings, gutters, all penetrations with reinforcements, supports for suspended items, pipings and conditions requiring closure strips and other accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

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B. Design Data for Metal Subroof System: Design metal subroof system under direct supervision of the manufacturer employed Engineer. Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and Regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers. Design Data submittal shall be signed and sealed by a qualified professional engineer licensed in the state or district in which the project is located. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect. Design Data submission must be concurrent with the submission of corresponding Fabrication drawings. Fabrication drawings submitted without corresponding Design Data will be returned as "Not Reviewed".

C. Initial Certification Letter from Delegated-Design Professional: Prior to the submission of Shop Drawings, Product Data, Calculations and other required submittals, submit a Certification Letter from the responsible design professional. No shop drawings will be reviewed by the Architect prior to the submission and acceptance of this Certification Letter. The Certification Letter shall include the following:

1. Signature and seal of the registered Professional Engineer (registered in the state or district in which the project is located).
2. Statement that the Professional Engineer is fully experienced in the design of metal wall systems.
3. Statement that all calculations and shop drawings are in accordance with the Contract Documents and applicable building codes and have been prepared under the direction of the Professional Engineer.
4. Statement that the Professional Engineer's signature and seal shall appear on all design calculations and on all shop drawings.
5. Statement that the design shall be in accordance with the aesthetic design intent of the project with the Architect having final authority in reference to aesthetic matters.
6. Statement that the Professional Engineer will submit an additional signed and sealed letter at the completion of the work related to this section stating that the fabrication and installation of the metal wall system has been performed in accordance with the Professional Engineer's design.

D. Qualification Data for the manufacturer, erector and professional engineer.

E. Product Test Reports: For each product, for tests performed by a qualified testing agency.

F. Field quality-control reports.

G. Sample Warranties: For special warranties.

1.6 RECORD SUBMITTALS

A. Final Certification Letter from Delegated-Design Professional: After construction of the metal wall system is complete, submit a signed and sealed Certification Letter from the responsible design professional stating that the fabrication and installation of the metal wall system has been performed in accordance with the Professional Engineer's design.

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1.7 CLOSEOUT DOCUMENTS

A. Warranties: Final warranties to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. An entity that employs installers and supervisors who are trained and approved by manufacturer.
2. Metal subroof system contractor shall have completed a minimum of five metal subroof projects similar in material, design and extent to that indicated for this project with a record of successful in-service performance. The metal subroof system contractor shall also be able to show a minimum of ten years ofexperience.

B. Professional Engineer's Qualifications: A Professional Engineer, who is legally qualified and licensed to practice in the State where the project is located, who is employed by the manufacturer, and who is experienced in providing engineering services of the kind indicated.

C. Statement of Specification Compliance: Both the metal wall system contractor and manufacturer shall submit and sign a statement that all materials supplied for this project shall only be manufactured by the specified manufacturer. It is the intent of this section that the metal wall system be provided as a complete system. Consequently, only materials, (including trim and accessories), supplied by the manufacturer will be accepted, unless specific exceptions are submitted and approved by the Architect.

D. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Build mockup of typical metal subroof assembly, including supports, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 COORDINATION

A. Coordinate metal subroof installation with other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide subroof deck and support framing capable of withstanding design loads within limits and under conditions indicated.

1. Design deck supports to carry the dead load of the deck plus items suspended below the deck and a live load of 10 pounds per square foot.

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2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Subroof Framing: Vertical deflection of 1/240 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, deck failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120º F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of building structure as follows:

   a. Upward and downward movement of 2 inches.

5. Submit a letter of certification from a professional structural engineer registered in the state or district in which the project is located and employed by the Subroof and Gutter Contractor that the subroof system, supports, connections and detailing are prepared under his direction and are in compliance with the contract documents and applicable code requirements. The professional structural engineer shall hold and maintain Professional Liability Insurance.

B. The subroof system contractor shall be fully responsible for the installation to be watertight including all flashings, gutters and drainpipe connections, all penetrations through the subroof plane, including watertightness of fasteners and mechanical, electrical, fire protection and other pipe, equipment and supports penetrating the enclosure.

C. Special Performance Requirements for Sprinkler Supports: Each pipe support element shall be capable of supporting the loads described in NFPA 13 - 99.

1. The structure shall support the weight of the water-filled pipe plus a point load of 250 pounds applied at the support element. The worst-case load from 6 inch Schedule 40 steel pipe is 650 pounds. Points of connection to the precast seating deck shall be coordinated with the deck contractor.
2. The support element shall be capable of supporting five times the weight of the water-filled pipe plus 250 pounds. The worst-case load for 6 inch Schedule 40 steel pipe is 2,150 pounds.

1.11 WARRANTY

A. Provide Owner with written warranty for 5 years if leaks occur in subroof or gutter system.

1. Warranty shall include all labor and materials required to access and repair and/or replace subroof.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide subroof deck and support framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on the Structural Drawings.

a. Design deck supports to carry the dead load of the deck plus items suspended below the deck and a live load of 10 pounds per square foot.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Subroof Framing: Vertical deflection of 1/240 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, deck failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120º F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of building structure as follows:

a. Upward and downward movement of 2 inches.

5. Submit a letter of certification from a professional structural engineer registered in the State of Pennsylvania and employed by the Subroof and Gutter Contractor that the subroof system, supports, connections and detailing are prepared under his direction and are in compliance with the contract documents and applicable code requirements. The professional structural engineer shall hold and maintain Professional Liability Insurance.

B. The subroof system contractor shall be fully responsible for the installation to be watertight including all flashings, gutters and drainpipe connections, all penetrations through the subroof plane, including watertightness of fasteners and mechanical, electrical, fire protection and other pipe, equipment and supports penetrating the enclosure.

C. Special Performance Requirements for Sprinkler Supports: Each pipe support element shall be capable of supporting the loads described in NFPA 13 - 99.

1. The structure shall support the weight of the water-filled pipe plus a point load of 250 pounds applied at the support element. The worst-case load from 6 inch Schedule 40 steel pipe is 650 pounds. Points of connection to the precast seating deck shall be coordinated with the deck contractor.
2. The support element shall be capable of supporting five times the weight of the water-filled pipe plus 250 pounds. The worst-case load for 6 inch Schedule 40 steel pipe is 2,150 pounds.

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2.2 MATERIALS

A. Steel for Galvanized Metal Units: ASTM A653, grade as required to comply with SDI specifications. 20 gauge 1-1/2 inches deck, intermediate rib, G90 galvanizing.

B. Miscellaneous Steel Shapes: ASTM A36.

C. Support Framing: Provide Unistrut support systems sizes and thickness to suit design load and length requirements and G90 galvanized metal hat channels as indicated and required to support subroof.

D. Sheet Metal Flashing, Counter Flashings, Gutters, Stand- Off Brackets and Accessories: ASTM A653, commercial quality, G90 galvanized or exposed coil- coated finish, 18 gauge unless noted otherwise. Provide strap angles, brackets and bracing as required to maintain uniform profile.

E. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

F. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

G. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand deign loads.

1. Use corrosion-resistant steel, stainless steel or finishes to match factory finished sheet metal fasteners.
2. Provide metal-backed neoprene washers under heads bearing on underside of panels.
3. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

2.3 FABRICATION

A. General: Form deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.

B. Roof Deck Units: Provide deck configurations that comply with "SDI Specifications and Commentary for Steel Roof Deck."

C. Metal Closure Strips and Flashings: Fabricate metal closure strips and flashings, terminations, etc. for openings between decking and other construction, of not less than 18 gage galvanized sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.

1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
2. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or deflection.

B. Fastening Deck Units: Use self-tapping No. 8 or larger machine screws at 3 feet on center for fastening end closures.

C. Fasten metal subroof to steel supporting members with self-tapping No. 8 or larger machine screws with neoprene washers, spaced not more than 12 inches on center with a minimum of 2 screws per unit at every support. In addition, secure deck to each supporting member in ribs where side laps occur. Fasten subroof deck units to steel structure above at HIGH RIB OF DECK ONLY. Provide watertight attachment to subroof with mechanical fasteners with neoprene gaskets/washer and sealant.

D. Mechanical fasteners: Locate mechanical fasteners and install in accordance with deck manufacturer's instructions.

E. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 36 inches on center using self-tapping No. 8 or larger machine screws, with neoprene washers.

F. Allowable Subroof Penetrations: The following items are allowed to penetrate the subroof system:

1. Certain walls shown on the drawings.
2. Storm drainage.
3. Sanitary drainage and vents.
4. Gas flues.
5. Suspension supports for HVAC units specifically identified in the drawings.
6. Fire protection piping supports.
7. Certain feeder conduits.
8. Structural framing members.

G. Preparation of Penetration: Allowable penetrations shall be made by sleeving deck units prior to installation of piping or conduit, or by cutting deck units to fit the item installed. Cutouts may be located at joints in the decking to allow two halves of the cutout to be slipped together. Hanger supports must be placed prior to installing deck units. Deck units must be drilled and

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hangers slipped through openings during deck installation.

1. All penetrations shall be sealed water tight with appropriate sealant as specified in Section 07900 "Sealants."All small penetrations shall occur within the high portion of the deck rib profile. These shall include threaded rod supports as well as small pipes.

2. All large penetrations which require multiflute cutouts shall be located at the highest point of the subroof so as not to impede water flow in the valleys of the deck resulting in water backup.

H. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown, flash all edges to assure positive rain drainage.

1. No penetrations through metal subroof, other than those listed above, are allowed unless specifically and individually approved by Architect.

I. Reinforcement at Openings: Provide additional deck support framing and metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work.

J. Items That Must Be Suspended Below Subroof: The following items must be secured through the deck to the steel angle deck supports or the building structure.

1. Horizontal storm or sanitary drainage lines larger than 3 inches diameter.
2. All fire protection piping and sprinkler lines.
3. Sections of HVAC ductwork.

K. Preparation for Suspended Items: Items shall be secured to steel angle deck supports by predrilling holes through the angle within the HIGH PORTION OF THE DECK RIB PROFILE. Appropriate anchors shall be set with neoprene washers and sealant.

L. Items That May Be Secured to the Subroof steel angle supports at the Contractor's Option: The following items may be secured to the subroof deck itself:

1. Suspended ceiling hanger wires.
2. Sections of HVAC ductwork with no dimensions over 24 inches.
3. Gas piping, refrigerated lines, plumbing and conduit ONLY WHERE SUPPORT FROM ADJACENT WALLS OR STRUCTURE IS IMPRACTICAL AS JUDGED BY THE ARCHITECT.
4. Light fixtures and other electrical devices indicated as being required in areas of exposed subroof.

M. Requirements for Optional Items Secured from the Subroof Supports: All loads for any allowable item secured to subroof supports shall be transferred to the structure above.

N. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of roof deck units.

O. Subroof Gutters: Fabricate gutters out of galvanized sheet metal at lowest end of metal deck

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subroof to collect water. Gutter size shall be 3" x 4" unless determined otherwise due to installation restrictions. Provide watertight end-closures at each section of gutter.

P. Raker Beam Gutters: Fabricate gutters out of galvanized sheet metal, along both sides of raker beams- sizes as shown on the drawings. Provide continuous counterflashing. Provide end dam closure at terminals of all gutters. Support raker beam gutters with strap hangers at 5 feet 0 inches o.c. Attach gutters to stand off brackets located at 5 feet 0 inches o.c.

Q. Gutter Outlets: Provide 2-inch diameter galvanized sheet metal outlets in base of gutters at locations indicated in the drawings or a minimum of two outlets per gutter section or at 40' o.c. maximum. Provide 2-inch extension. Weld to underside of gutter and coat with galvanizing repair paint.

R. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Fasten securely into position to provide a complete decking installation.

S. Counterflashing: Coordinate installation of counterflashing with installation of gutters. Extend counterflashing over gutter flashing. Seal at all connections and top edge of flashing and counterflashing.

T. Cementitious Fireproofing: Where indicated, Gutters, straps, anchors, stand off brackets, counter flashing must be installed to steel beams. Carefully remove cementitious fireproofing only at connection points prior to gutter installation. Subcontractor must reapply cementitious spray fireproofing after installation of gutters to ensure proper application.

U. Subcontractor must properly maintain gutters to ensure they are free of all debris and miscellaneous items prior to installation of final piping and subroof.

V. Touch-Up Painting: Prior to decking installation, wire brush, clean, and paint scarred areas, and rust spots on top surfaces of decking units and supporting steel members. After decking installation, wire brush, clean, and paint scarred areas, and rust spots on bottom surfaces of decking units and supporting steel members.

3.2 WATER TEST

A. In-place Testing: Conduct a leak test in the presence of the Architect by spraying sub-roof areas with water through a garden hose. Repair any leaks and repeat test until no leakage is observed.

END OF SECTION 05 31 50

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SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior load-bearing wall framing
2. Floor joist framing

B. Related Sections include the following:

1. Division 07 Section "Thermal Insulation"
2. Division 07 Section "Joint Sealants"
3. Division 09 Section "Gypsum Board Systems" for interior non-load-bearing, metal-stud-framed assemblies

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Provide shop drawings prepared by the cold-formed metal manufacturer.

1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, fastening and anchorage details, including mechanical fasteners.
2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Submit signed and sealed Shop Drawings in accordance with Division 01 Section “Submittal Procedures”.
4. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, design loads, support points and tie backs.
5. The design shall be in accordance with the aesthetic design intent of the project with the Architect having final authority in reference to aesthetic matters.

C. Design Criteria

1. Conform to local and state codes.

2. Provision for Movements in Structural Frame: Detail metal stud curtain wall and supports to provide for movement in structural frames as indicated on the Drawings.
3. Structural Criteria

    a. Support conditions for the metal stud curtainwall system shall be as indicated on the structural drawings.
    b. Design to withstand the secondary architectural wind loads shown on the structural drawings.
    c. Deflection of metal framing members in a direction normal to the plane of the wall shall not exceed L/360 of the clear span of member or 0.75 inch, whichever is least.
    d. Sheathing board shall be neglected for diaphragm action. Diagonal straps and bridging shall be designed to accommodate all loading conditions.
    e. The metal stud curtainwall system shall be designed to support all exterior wall construction that is framed to the metal stud system, including the weight of that construction and any lateral forces transmitted from that construction to the metal stud curtainwall system.
    f. Design for most stringent structural criteria listed above.
    g. The metal stud curtainwall system shall be designed to support the horizontal load from snowdrift build-up and parapet wind loads as applicable.

1.5 INFORMATIONAL SUBMITTALS

A. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Design Data for Delegated Design Elements

1. All design calculations, which shall bear the seal and signature of the cold-formed design engineer indicating compliance with the requirements of the design criteria and appropriate codes, shall be provided to the Architect concurrent with the submittal of shop drawings. Shop drawings submitted without corresponding Design Data will be returned as “Not Reviewed”.

C. Welding certificates

D. Qualification Data:

1. For professional engineer
2. For testing agency
3. For fabricator
4. For erector

E. Submit manufacturer's literature for installation of materials specified.

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet
2. Expansion anchors
3. Power-actuated anchors
4. Mechanical fasteners
5. Vertical deflection clips

6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories

G. Research/Evaluation Reports: For cold-formed metal framing.

1.6 QUALITY ASSURANCE

A. Qualifications for Fabricator and Erector:

1. The fabricator shall have a minimum of 5 years of experience in the fabrication of metal stud curtain wall systems and shall have successfully fabricated a minimum of 5 projects similar to this project.
2. The erector shall have a minimum of 5 years of experience in the erection of metal stud curtain wall systems and shall have erected a minimum of 5 projects similar to this project.

B. Delegated Design Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency**,** or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility**,** and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. AISI Specifications and Standards: Comply with AISI's S100 "North American Specification for the Design of Cold-Formed Steel Structural Members" and its S200 "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Material shall be delivered in original unopened packages, fully identified as to manufacturer, brand or other identifying data, and bearing the proper Underwriters Laboratories, Inc., or other approved agency, labels for fire hazard and fire-resistance classification.

B. Material shall be stored above ground, under cover and in a dry location until ready for use. All containers that have been exposed to water before use shall be found unsuitable for use and discarded. Stock of material is to be rotated and used prior to its expiration date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Cold Formed Metal Panels:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich, West Chester, Ohio.
b. Marino/Ware Industries, South Plainfield, New Jersey
c. The Steel Network, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated. Refer to the structural drawings for general notes and for the required support conditions and connection types to the primary structure.

1. Design Loads: As indicated.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Interior Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
b. Floor Joist Framing: Vertical deflection of 1/480 for live loads and l/360 for total loads of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

B. Cold-Formed Steel Framing Standards: Design according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

C. Delegated Design: Design cold-formed metal-framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H or ST50H as required by structural performance.
2. Coating: G60.

2.4 INTERIOR LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base- Steel Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base- Steel Thickness: Matching steel studs.
2. Minimum Flange Width: 1-1/4 inches.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780.

B. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1-part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, non-leaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

1. Basis of Design: Subject to compliance with requirements, provide H-B, Inc.; NS – Closed Cell Neoprene Sponge, or approved equal.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations at exterior non-gravity load bearing walls only.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C1007, AISI's S200 "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Install Cold Formed Framing at 16 inches on center maximum, or closer, as required by design requirements.

J. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

K. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Tolerance shall be maintained to comply with the requirements of the Division 07 Section “Metal Wall Panel” manufacturer.

3.4 INSTALLATION

A. Stud System

1. Install tracks at floor and structure above and secure. At track butt joints, securely anchor abutting pieces of track to a common structural element; reinforce joint with a section of stud nested in track and screw fastened at track flanges. Studs shall be one piece (no splicing), spaced 16 inches o.c. maximum, and shall extend from floor to underside of structure. Fasten bottom of studs to track, one screw in each flange; do not fasten top of studs to secured top track. Interrupt top and bottom tracks at control joints.
2. Provide 1-1/2 inch cold rolled channel bracing, one row at midpoint of height or maximum 6 feet above bottom track, and one row at top (first opening below top of stud) inserted in stud cutouts or as directed by the Engineer of Record. If design of cutouts is such that 1-1/2 inch channel cannot be friction-fit for rigidity, weld each flange of channel (both sides) to studs or screw attach to 1-1/2 inch x 2 inch x 16 gauge clip angle with four screws, two into each member.
3. Provide horizontal bracing to support wall mounted fixtures, casework, guard rails, other equipment.
4. Install members true to lines and levels to provide surface flatness with maximum variation of 1/8 inch in a 4-foot radius at any location.
5. Attach runners, studs, bracing, or any other component of partition system only to building floors, walls or structural framing.
6. Door Opening Framing: Install double studs at door frame jambs with minimum of three "U" shaped strap anchors to join studs together. Run the double studs from floor to underside of structure above. Install runners at frame head height between jamb studs. Perform work per recommendations of GA 219 for heavyweight doors.

3.5 INTERIOR LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and web of track. Fasten both flanges of studs to top and bottom tracks. Maximum stud spacing as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Install headers over wall opening wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

E. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

F. Install horizontal bridging in stud system, spaced as indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055133

METAL LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop-fabricated metal ladder with safety cage.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.3 QUALITY ASSURANCE

A. Design roof access ladder under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.1 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.2 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
4. Manufacturers:
   a. Industrial Ladder & Scaffolding, Inc.
   b. O'Keeffe's Inc.
   c. Precision Ladders, LLC.
   d. Substitutions: See Section 016000 - Product Requirements.

2.4 FINISHES - ALUMINUM

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.5 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 055213

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Free-standing railings at steps.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS D1.1/D1.1M or AWS D1.2/D1.2M, and dated within the previous 12 months.

D. Fabricator's Qualification Statement.

1.3 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Fabricator Qualifications:

1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice

connectors, flanges, escutcheons, and wall brackets.

2.2 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

C. Exposed Fasteners: No exposed bolts or screws.

2.3 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

E. Exposed Fasteners: No exposed bolts or screws.

F. Galvanizing: In accordance with requirements of ASTM A123/A123M.

2.4 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Weld connections that cannot be shop welded due to size limitations.

1. Weld in accordance with AWS D1.1/D1.1M.
2. Match shop welding and bolting.
3. Clean welds, bolted connections, and abraded areas.
4. Touch up shop primer and factory-applied finishes.
5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

2.5 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure where required.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 061053

MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof-mounted curbs.

B. Roofing nailers.

C. Roofing cant strips.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Southern Pine, unless otherwise indicated.
2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry or MC15.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No.2 or Standard Grade.
2. Boards: Standard or No.3.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; minimum 1/2 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.5 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Do not use treated wood in direct contact with ground.

C. Preservative Treatment:

1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A.
   a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.2 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.3 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.4 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.5 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 061600

SHEATHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheathing.

1.2 SUBMITTALS

A. Manufacturer's Certificate: Certify that wood products supplied for wood sheathing meet or exceed specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.1 CONSTRUCTION PANELS

A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.

1. Bond Classification: Exterior.
2. Span Rating: 24.
3. Performance Category: 5/8 PERF CAT.

B. Wall Sheathing: Gypsum, complying with requirements of ASTM C1396/C1396M for gypsum sheathing, V-shaped long edges, 5/8 inch Type X fire resistant.

2.2 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.2 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

3.3 TOLERANCES

A. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.4 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 062000

FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

B. Protect from moisture damage.

C. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.2 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Fasteners: Of size and type to suit application.

2.3 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

D. Provide identification on fire retardant treated material.

E. Redry wood after pressure treatment to maximum 13 percent moisture content.

2.4 SITE FINISHING MATERIALS

A. Field Finishing: See Section 099123.

2.5 FABRICATION

A. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.3 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 099113 and 099123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.4 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 067300

COMPOSITE DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plastic composite decking.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published product literature:

C. Shop Drawings - Plastic Composite Decking: For each system; indicate:

1. Plans and Sections: Include column centers, elevations, and dimensions, indicating locations of members and connections.
2. Details: Include framed openings.

D. Samples: Submit two samples, 12 inches by 12 inches in size, indicating specified texture and finish.

E. Manufacturer's Instructions: Manufacturer's published installation instructions.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Experience: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in installing work of type specified in this section, and with at least three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, unbroken packages, or bundles bearing label of manufacturer and component identification markings.

B. Store materials under cover and elevated above grade.

C. Protect decking units from damage including cracking or chipping.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within five year period after Date of Substantial Completion.

C. Provide manufacturer's standard limited warranty for products.

PART 2 PRODUCTS

2.1 PLASTIC COMPOSITE DECKING

A. Manufacturers

1. Deckorators, Inc.
2. DuxxBak Composite Decking.
3. Trex Company, Inc.
4. Wolf Home Products.
5. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Composite Decking: Extruded thermoplastic composite decking boards; for exterior applications where ICC (IBC) permits combustible construction; complying with ASTM D7032.

1. Finish: Manufacturer's standard finish; in compliance with specified slip resistance requirements.
2. Color: To be selected by Architect from manufacturer's full range.
3. Flame Spread Index: 200 or less when tested in accordance with ASTM E84.

C. Accessories:

1. Manufacturer's standard fasteners and anchorage devices.

PART 3 EXECUTION

3.1 EXAMINATION - GENERAL

A. Verify dimensions, tolerances, and interfaces with related work; verify location of supporting assemblies.

B. Examine field conditions to confirm that building lines, grades, and elevations will allow proper installation of decking.

C. Verify substrates to determine that conditions are acceptable for installation of decking in accordance with manufacturer's written instructions.

3.2 INSTALLATION - GENERAL

3.3 INSTALLATION - PLASTIC COMPOSITE DECKING

A. Install decking in accordance with manufacturer's published instructions, subject to conditions of its evaluation report.

3.4 TOLERANCES

A. Install decking complying with installation tolerances indicated in ANSI/ACMA/PIC (CSP).

3.5 PROTECTION

A. Protect installed decking from subsequent construction operations.

END OF SECTION

SECTION 068316

FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 12 by 12 inch in size illustrating material and surface design of panels.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Panels: Quantity equal to 5 percent of total installed.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Crane Composites, Inc.
2. Marlite, Inc.
3. Nudo Products, Inc.
4. Panolam Industries International, Inc.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PANEL SYSTEMS

A. Wall Panels:

1. Panel Size: 4 by 8 feet.
2. Panel Thickness: 0.10 inch.
3. Surface Design: Embossed.
4. Color: White.

5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.3 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
4. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.2 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 071113

BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, cut-back-asphalt dampproofing.

B. Sustainable Design Requirements: Refer to Section 018113 “Sustainable Design Requirements” for requirements affecting work of this section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

B. Perm Rating: 0.23 metric perms at 40 mils dry film thickness.

2.3 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Karnak Company.
2. Henry Company.
3. W. R. Meadows, Inc.

B. Trowel Coats: ASTM D4586/D4586M, Type I, Class 1, fibered.

C. Brush and Spray Coats: ASTM D4479/D4479M, Type I, fibered.

2.4 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Asphalt Primer: ASTM D 41.

C. Asphalt-Coated Glass Fabric: ASTM D 1668/D 1668M, Type I.

D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.

B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.

D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.

1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.

1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

D. Where dampproofing interior face of above-grade, exterior concrete and masonry walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

E. Do not use dampproofing at retaining wall locations with habitable space below grade.

3.4 INSTALLATION OF COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

A. Concrete Foundations and Parged Masonry Foundation Walls: Apply one trowel coat at not less than 4 gal./100 sq. ft.

B. Unparged Masonry Foundation Walls: Apply primer and one trowel coat at not less than 4 gal./100 sq. ft.

C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft.

E. Concrete Backup for Masonry Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft.

F. Masonry Backup for Masonry Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft.

G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft.

3.5 PROTECTION

A. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION

SECTION 071300

SHEET WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-adhered HDPE sheet membrane.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

I. Specimen Warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.4 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of

concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.1 SHEET WATERPROOFING MATERIALS

A. Self-Adhered HDPE Sheet Membrane: Recommended by manufacturer for placement below concrete slabs and on outside face of below grade walls before placement of concrete.

1. Sheet Thickness: 32 mil, 0.032 inch, minimum.
2. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
3. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 231 feet head of water applied in accordance with test method ASTM D5385/D5385M.
4. Elongation at Break: 500 percent, minimum, measured in accordance with ASTM D412.
5. Tensile Strength, Film: 3,500 psi, minimum, measured in accordance with ASTM D412.
6. Adhesion: 150 psi, minimum, measured in accordance with ASTM D4541.
7. Water Vapor Permeance: 0.01 perm, maximum, measured in accordance with ASTM E96/E96M.
8. Lateral Water Migration Resistance: Resists pressure of 231 ft head of water, when tested in accordance with ASTM D5385/D5385M.
9. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
10. Basis of Design – Preprufe 300R Plus/LT as manufactured by GCP Applied Technologies. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:
    a. Carlisle Coatings & Waterproofing Inc.
    b. Polyguard Products, Inc.
    c. W.R. Meadows, Inc..
    d. Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Seaming Materials: As recommended by membrane manufacturer.

B. Membrane Sealant: As recommended by membrane manufacturer.

C. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

D. Waterstop: Type as recommended by waterproofing manufacturer.

E. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.

1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.

2. Thickness: As indicated on drawings.
3. Products:
   a. Advanced Building Products, Inc; ABP AdvancedDrain Polymeric Drainage Mat: www.advancedbuildingproducts.com/#sle.
   b. Hyload, Inc; HyDrain 200: www.hyload.com/#sle.
   c. W.R. Meadows, Inc; Mel-Drain 5012: www.wrmeadows.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

F. Cant Strips: Premolded composition material.

G. Flexible Flashings: Type recommended by membrane manufacturer.

H. Counterflashings: See Section 076200.

I. Termination Bars: Aluminum; compatible with membrane and adhesives.

J. Adhesives: As recommended by membrane manufacturer.

K. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

E. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.3 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Install building expansion joints at locations as indicated on drawings.

H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

I. Seal membrane and flashings to adjoining surfaces.

J. Waterstop: Install waterstop according to manufacturer's instructions.

3.4 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.

B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

C. Adhere protection board to substrate with compatible adhesive.

3.5 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 18 13

PEDESTRIAN TRAFFIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a polyurethane traffic coating system as specified and as indicated on the Drawings.

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 03 53 00 – CONCRETE TOPPING.
2. Section 06 16 00 – SHEATHING.
3. Section 07 60 00 – FLASHING AND SHEET METAL.
4. Section 07 92 13 – ELASTOMERIC JOINT SEALANTS.
5. Section 07 27 26 – FLUID APPLIED MEMBRANE AIR BARRIER

1.3 PERFORMANCE REQUIREMENTS

A. Two-component, chemically curing, aliphatic fluid applied polyurethane traffic membrane with integral texture aggregate for use subject to pedestrian traffic. The waterproofing system is intended to perform as a continuous barrier against liquid water and to flash or discharge to the incidental water. Membrane system shall accommodate movements of building materials as required with accessory sealant materials at such locations including: changes in substrate, perimeter conditions, control joints, railing posts, drains and penetrations.

B. Installed waterproofing membrane/surfacing system shall not permit the passage of water and will withstand the anticipated pedestrian traffic wear exposures in accordance with the most current revision of ASTM C957, High-Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface.

C. Intent is to bridge and seal the following air and water leakage pathways and gaps:
1. Connections of the walls to the deck.
2. Piping, conduit, duct and similar penetrations.
3. All other air leakage and water intrusion pathways to building envelope connections.

1.4 SUBMITTALS

A. Submittals: Comply with project requirements for submittals as specified in Division 01.

B. Product Data:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Drawings or catalog illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades.

4. Manufacturer's current recommended installation procedures.

C. Mock-Ups: Provide a mock-up on site to demonstrate workmanship and final appearance. Locate in an area acceptable to the Architect. Accepted mock-up may remain in place.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer shall have at least three years of experience in installing materials of types specified and shall have successfully completed at least three projects of similar scope and complexity.
2. Installer shall designate a single individual as project foreman who shall be on site at all times during installation.

B. Field Adhesion Test Method: Use manufacturer's standard field adhesion test methods and methods to verify proper priming and surface preparation techniques required to obtain optimum adhesion. Evaluate and report results of field adhesion testing to EOR and or Owner.

C. Waterproofing Terminology: Refer to ASTM D1079 and the glossary of the Sika Waterproofing Manual for definitions of waterproofing terms related to this section.

1.6 PRE-INSTALLATION CONFERENCE

A. Prior to scheduled commencement of installation and associated work, conduct a meeting at the project site with the installer, architect/consultant, owner, manufacturer’s representative and any other persons directly involved with the performance of the Work. The Installer shall record conference discussions and to include decisions and agreements reached (or disagreements) and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to the Work.

1.7 REGULATORY REQUIREMENTS

A. Applicable Regulations: Comply with local code and requirements of authorities having jurisdiction. Do not exceed VOC regulations as established by the State in which they are being installed; including total VOC content, in grams per liter, for all system components (i.e. primers, adhesives, coatings, and similar items.)

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's unopened containers with all labels intact and legible at time of use. Handle and store materials in accordance with manufacturer's recommendations with proper precautions to ensure fitness of material when installed.

1.9 WARRANTY

A. Warranty: Provide manufacturer’s standard warranty for each type of product and system. Include written testing documentation and test reports if requested by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Sika Corporation.

2.2 PEDESTRIAN BALCONY COATINGS (SIKALASTIC 726 BALCONY ONE SHOT SYSTEM)

A. Pedestrian Traffic Coating: Sikalastic 726 Balcony One Shot System comprised of the following:

1. **Optional primers** as determined by field conditions. Sikalastic 726 Balcony One Shot System is primerless for many applications. Verify the need for a primer with the manufacturer especially when overcoating an existing traffic membrane. Sample mock ups are typically required to confirm acceptable adhesion:
   1. Sikalastic Primer fast curing 1C PU primer.
   2. Sikalastic FTP Lo-VOC 100% solids epoxy primer (as a standard primer and for recoat applications, elevated moisture content up to 6% determined by a Tramex Moisture Meter, and plywood decks).
   3. Sikalastic MT 100% solids epoxy primer (for substrates over unvented metal pan decks or applications with elevated moisture content up to 6 % determined by a Tramex Moisture Meter).
   4. Sikalastic EP Primer Rapid – Metal surfaces to be overcoated remove rust before priming.
   5. Sikaflex 260 Primer – Metal surfaces to receive Sikaflex sealant cant beads remove rust before priming.
   6. Note do not proceed with the application of the Sikalastic 726 Balcony One Shot System if the deck is outgassing. Wait for temperatures to be dropping before starting the work.
   7. Sikalastic 720 Base two-component aromatic polyurethane base coat detailing of cracks, joints or flashing details as required.
   8. Sikalastic 710 Base single-component aromatic polyurethane base coat detailing of cracks, joints or flashing details as required.

B. Applied Total Dry Film Thickness:

1. Sikalastic 726 Balcony One Shot System Membrane: 38 mils wet, 35 mils dry yield.

C. Aggregate:

1. Integrally textured for slip resistance. No need to add additional aggregate to the Sikalastic 726 Balcony One Shot Pedestrian Membrane System.

2. Decorative aggregate: not recommended for use with the Sikalastic 726 Balcony One Shot system instead use Sikalastic 710/735AL/748PA coating. The selection of aggregate for this system is that it must be UV-stable, ceramic-coated quartz aggregate in a standard or custom color blend. Intended for a full broadcast application where a clear sealcoat will be applied. Aggregate shall be supplied in pre-blended and packaged bags to insure uniformity.

D. Fabric Reinforcement: Typically required for local reinforcing of a “detail coat” in seams over plywood decks. Use polyester tape - Sikalastic Flexitape Heavy where reinforcing is required.

E. Coating: Typical Physical properties complying with the following.
   1. Sikalastic 726 Balcony One Shot - Aliphatic Coating

1.	Pot Life	20-30 minutes
2.	Total Volume Solids (ASTM D2697)	92%
3.	Tensile Strength (ASTM D412)	2400 +/- 200 psi
4.	Elongation at Break (ASTM D412)	500 +/- 50%
5.	Tear Resistance (Die C, ASTM D624)	300lbf/in. +/- 50 lbf/in.
6.	Shore A Hardness (ASTM D2240)	90 +/- 5
7.	Film Thickness	35 mils (38 WFT) 50 sf/1.18-gal A + B mix

   8. Tests were performed with material and curing conditions at 75F and 50% relative humidity.

2.3 Properties of optional Sikalastic detail coats where required:

A. Sikalastic 710 Base Coat

1.	Viscosity	6500 +/- 3000 cps
2.	Total Volume Solids (ASTM D2697)	71%
3.	VOC Content (ASTM D2369-81)	240 g/l
4.	Tensile Strength (ASTM D412)	800 +/- 100 psi
2. 5.	Elongation at Break (ASTM D412)	500 +/- 50%
3. 6.	Tear Resistance (Die C, ASTM D624)	170 +/- 25 pli
4. 7.	Hardness (ASTM D2240)	55 +/- 5 Shore A
5. 8.	Film Thickness 23 DFT (32 WFT)	50 sq.ft./gallon

9. Tests were performed with material and curing conditions at 75F and 50% relative humidity.
6.
7.

8. B. Sikalastic 720 Base Coat:

1.	Pot Life	10-15 minutes
2.	Total Volume Solids (ASTM D2697)	100%
3.	VOC Content (ASTM D2369)	<15 g/l
4.	Tensile Strength (ASTM D412)	2,500 psi (+/- 100 psi)
5.	Elongation at Break (ASTM D412)	800% (+/- 50%)
6.	Tear Resistance (Die C, ASTM D624)	300 pli (+/- 25 pli)
7.	Hardness (ASTM D2240)	80 +/- 5 Shore A
8.	23 DFT (23 WFT)	70 sq.ft./gallon

9. Tests were performed with material and curing conditions at 75F and 50% relative humidity.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the Work of this section. Notify Architect in writing of any discrepancies. Commencement of the Work in an area shall mean Installer's acceptance of the substrate.

3.2 PREPARATION

A. Substrates shall be clean, dry, sound and free of surface contaminants, with an open texture. Remove all traces of dust, laitance, grease, oils, curing compounds, form release agents and foreign particles by mechanical means, such as milling, scarifying, or shotblasting, as acceptable to the Architect. Blow surface free of dust using compressed air line-equipped with an oil trap. All projections, depressions and rough spots should be dressed off to achieve a level surface prior to the application.

B. Concrete shall be cleaned and prepared to achieve a laitance and contaminant free, open textured surface by blast cleaning or equivalent mechanical means (CSP 3-4 per ICRI guidelines).

C. Plywood shall be clean and smooth, APA and exterior grade, not less than 1/2-inch-thick, and spaced and supported according to APA guidelines. Seams should be sealed with Sikaflex 2c or 1a and apply a 4" wide detail base coat layer with imbedded Sikalastic Flexitape Heavy fabric tape reinforcement centered over the seams and flashed up onto the wall(s).

D. Metal shall be thoroughly cleaned by grinding or blast cleaning follow with a solvent wipe of Xylol and primed with a metal primer: Sikalastic EP Primer Rapid, Sikaflex 260 Metal Primer.

3.3 PRIMING – **Do not proceed with membrane work if deck is outgassing conduct a rubber mat test to confirm no outgassing is present.**

A. Concrete (<4% moisture content by weight, measured with Tramex Concrete Moisture Encounter Meter):

1. Apply Sikalastic FTP Lo-VOC primer at 200 sf/gal. with a flat squeegee or roller and work well into the substrate to insure adequate penetration and sealing. Puddles are to be avoided. Premix both components. Add the 5 gallons of Sikalastic FTP Lo-VOC Primer, Part “B” to the 10 gallons of Part “A”. Mix thoroughly with a mechanical mixer (Jiffy) for 3 minutes. This mixture will appear as a green transparent color. Allow primer to cure a minimum of 12 hours at 70°F and 50% RH or until tack free before applying second primer or base coat.

B. Concrete (4% to 6% moisture content by weight, measured with Tramex Concrete Moisture Encounter Meter):

1. For concrete substrates with 5% maximum moisture content by weight, apply Sikalastic MT Primer at 175 sf/gal. with a flat squeegee or roller and work well into the substrate to insure adequate penetration and sealing. Puddles are to be avoided. For concrete substrates with >5% up to 6% maximum moisture content by weight, apply a second coat of Sikalastic MT primer at 175 sf/gal. Refer to data sheet for more detailed information, or consult Sika for other primer options. Premix both components. Sikalastic MT Primer, Part “A” is red in color. Sikalastic MT Primer, Part “B” is light amber in color. Add the 1.5 gallon of Sikalastic MT Primer, Part “B” to the 3 gallons of Part “A” in the short-filled Part “A” pail. Mix thoroughly with a mechanical mixer (Jiffy) for 3 minutes. This mixture will appear as a red transparent color. Allow primer to cure a minimum of 12 hours at 70°F and 50% RH or until tack free before applying second primer or base coat.
1.
2. For concrete substrates with 5% maximum moisture content by weight, apply Sikalastic FTP Lo-VOC primer at 200 sf/gal. with a flat squeegee or roller and work well into the substrate to insure adequate penetration and sealing. Puddles are to be avoided. For concrete substrates with >5% up to 6% maximum moisture content by weight, apply a second coat of Sikalastic FTP Lo-VOC primer at 200 sf/gal. Premix both components. Add the 5 gallons of Sikalastic FTP Lo-VOC Primer, Part “B” to the 10 gallons of Part “A”. Mix thoroughly with a mechanical mixer (Jiffy) for 3 minutes. This mixture will appear as a green transparent color. Allow primer to cure a minimum of 12 hours at 70°F and 50% RH or until tack free before applying second primer or base coat.
2.

3. Metal: Metal shall be thoroughly cleaned by grinding or blast cleaning follow with a solvent wipe of Xylol and primed with a metal primer: Sikalastic EP Primer Rapid, Sikaflex 260 Metal Primer.

C. Plywood

4. Apply Sikalastic FTP Lo-VOC primer at 200 sf/gal. with a flat squeegee or roller and work well into the substrate to insure adequate penetration and sealing. Puddles are to be avoided. Premix both components. Add the 5 gallons of Sikalastic FTP Lo-VOC Primer, Part “B” to the 10 gallons of Part “A”. Mix thoroughly with a mechanical mixer (Jiffy) for 3 minutes. This mixture will appear as a green transparent color. Allow primer to cure a minimum of 12 hours at 70°F and 50% RH or until tack free before applying second primer or coating.

3.4 DETAILING

A. Non-Structural Cracks up to 1/16 inch: Apply a detail coat of Sikalastic 720 Base at 23 mils wet 4 inches wide, centered over the crack. Or apply a detail coat of Sikalastic 710 Base at 32 wet mils 4 inches wide, centered over the crack. Allow to become tack free before overcoating.

B. Cracks and Joints over 1/16 inch up to 1 inch: Rout and seal with Sikaflex 2c NS/SL or Sikaflex1a sealant and allow to skin over and cure. Apply a detail coat of Sikalastic 720 Base at 23 mils wet 4 inches wide, centered over crack. Or apply a detail coat of Sikalastic 710 Base at 32 wet mils 4 inches wide, centered over the crack. Allow to become tack free before overcoating.

C. Fabric Reinforcement: An optional 3” or 6” wide Sikalastic Flexitape Heavy fabric strip may be embedded within a detailing base coat. Flexitape width shall be chosen such that a minimum of 1” tape is embedded on either side of the crack/joint. Apply additional base coat as required to fully embed the Flexitape Heavy in the coating. Allow to become tack free before overcoating.

D. Joints over 1 inch: Treat as expansion joints and brought up through the Sikalastic 726 Balcony One Shot Traffic System and sealed with Sikaflex 2c NS/SL or Sikaflex1a sealant.

3.5 Sikalastic 726 Balcony One Shot system

A. Sikalastic 726 Balcony One Shot: Premix the Part A component using a low speed (400–600 rpm) mechanical mixer and Jiffy Paddle (2-5 Gallon Model) to obtain uniform color, making sure to scrape the solids from the bottom and sides of the pail. Pour Part C slowly into Part A and ensure aggregate from Part C is fully mixed into Part A. Slowly pour Part B into Part A/C mix and while mixing scrape the side of the container. Mix the combined material thoroughly until a homogenous mixture and uniform color is obtained (typically 3 minutes). Use care not to allow the entrapment of air into the mixture. Do not break down kits into smaller quantities; portions are premeasured. Use care not to allow the entrapment of air into the mixture. Apply at the recommended coverage rate of 43 sq.ft./gallon to yield 38 WFT, using a 1/4” notched squeegee or trowel, and backroll using a 3/8” phenolic resin core roller. Extend coating over entire area including previously detailed cracks and control joints. Coating should be tack free after about 6 hours at 70°F and 50% RH; base coat must be tack free before overcoating. Allow it to cure minimum of 8 hours before opening to pedestrian traffic.

1.

3.6 Limitations

A. Avoid dew point conditions during application relative humidity must be no more than 95% and substrate temperatures must be at least 5°F above measured dew points temperature.

B. Maximum moisture content of the concrete substrate by weight when measured with a Tramex CME is 4%. Refer to primer recommendations above and as listed on the Technical Data Sheet.

C. Minimum ambient substrate temperatures during application and curing are 40°F with the maximum of 95°F.

D. Do not store materials outdoors exposed to direct sunlight and moisture. Cover and protect materials stored on site with breathable type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Observe temperature storage and conditioning requirements found on the Technical Data Sheet.

E. Do not thin with solvents.

F. Minimum age of concrete is 21-28 days.

G. Consult Sika for any surface repairs recommendations. Surface irregularities may reflect through the finished coating.

H. Do not apply the coating to any porous or damp surface where moisture vapor transmission will occur during application and cure.

I. Substrates must be dry prior to application. Do not apply to a frosted, wet or damp surface.

J. Do not proceed with installation if rain is imminent within 6 – 12 hours of application. Allow sufficient time for the substrate to dry after rain or inclement weather as there is the potential for bonding problems.

K. When applying over an existing coating a mock up is required to confirm compatibility and an acceptable adhesion result can be achieved. Contact the manufacturer for testing.

L. Precautions should be taken to prevent odors and/or vapors from entering the building/structure, including but not limited to turning off and sealing air intake vents or other means of ingress for odors and for vapors into the building/structure during product application and cure.

M. On grade, lightweight concrete, asphalt pavement, or insulated split slab applications must not be coated with the Sikalastic 726 Balcony One Shot without Sika Technical Review. Contact Sika Technical Services or Product Engineering.

N. Unvented metal pan decks or decks containing a between slab membrane require further technical evaluation and priming with a moisture tolerant primer – contact Sika regarding recommendations.

O. Do not subject the Sikalastic 726 Balcony One Shot system to a continuous water immersion condition.

P. Mock ups to verify application methods and substrate conditions as well as desired skid resistance and aesthetics are highly recommended.

Q. Sikalastic 726 Balcony One Shot system requires proper water management including proper drainage on a waterproofing membrane and proper use of pitched or a sloped substrate.

3.7 CLEANING

A. Remove uncured materials from tools or other surfaces with an approved solvent. Remove cured materials by mechanical means.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

PESTRIAN TRAFFIC COATINGS 071813

SECTION 072100

THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, and exterior wall behind metal wall panels wall finish.

B. Batt insulation in exterior wall and ceiling construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.3 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation on Inside of Concrete and Masonry Exterior Walls: Extruded polystyrene (XPS) board.

D. Insulation in Framed Walls: Batt insulation with integral vapor retarder.

E. Insulation in Framed Walls: Batt insulation with no vapor retarder.

F. Refer to the drawings for all other insulation types and locations

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Edges: Square.
7. Products:
    a. DuPont de Nemours, Inc.
    b. Kingspan Insulation LLC.
    c. Owens Corning Corporation.
    d. Substitutions: See Section 016000 - Product Requirements.

2.3 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
4. Facing: Kraft faced and unfaced.
5. Products:
    a. CertainTeed Corporation.
    b. Johns Manville.
    c. Owens Corning Corporation.
    d. Substitutions: See Section 016000 - Product Requirements.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Provide foil facing on one side, at locations indicated on drawings.
4. Products:
    a. Johns Manville.
    b. Knauf Insulation.
    c. ROCKWOOL; COMFORTBATT.
    d. Thermafiber, Inc.
    e. Substitutions: See Section 016000 - Product Requirements.

2.4 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.
2. Width: Are required for application.

B. Flashing Tape: Special reinforced film with high performance adhesive.

1. Application: Window and door opening flashing tape.
2. Width: As required for application.
3. Primer: Tape manufacturer's recommended product.

C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

1. Width: 3-1/2 inches.
2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

D. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

E. Air and Moisture Sealing Insulation Fasteners: Preassembled fastener units consisting of sealing washer, screw, and gasketing tube.

1. Length as required for thickness of insulation material and penetration of deck substrate.
2. Thread and tip types as required for substrate material.
3. Products:
   a. TruFast Walls, a Division of Altenloh, Brinck & Co. US, Inc; Grip-Deck TubeSeal.
   b. Substitutions: See Section 016000 - Product Requirements.

F. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

G. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inches wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

1. Tape seal joints.
2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:

1. Three continuous beads per board length.

C. Install boards horizontally on foundation perimeter.

1. Place boards to maximize adhesive contact.
2. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.

3.3 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.

B. Apply adhesive to back of boards:

1. Three continuous beads per board length.

C. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.

D. Install boards vertically on walls.

1. Place boards to maximize adhesive contact.
2. Butt edges and ends tightly to adjacent boards and protrusions.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.4 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.5 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape insulation batts in place.

G. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

H. At wood framing, place vapor retarder on warm side of insulation by stapling at 6 inches on center. Lap and seal sheet retarder joints over face of member.

I. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

J. Tape seal tears or cuts in vapor retarder.

K. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

L. Coordinate work of this section with construction of air barrier seal, see Section 072700.

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 072119

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Foamed-in-place insulation.

1. On underside of metal roof deck.
2. Other locations where indicated on drawings.

B. Protective intumescent coating.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

E. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.5 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Foamed-In-Place Insulation:

1. BASF Corporation.
2. Carlisle Spray Foam Insulation.
3. Huntsman Building Solutions.
4. Johns Manville.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Foamed-In-Place Insulation: Low-density, flexible, closed cell, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
   a. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
2. Thermal Resistance: R-value of 3.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
3. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.3 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent type, spray applied; flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.2 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.3 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply protective coating monolithically, without voids, to fully cover foam insulation.

C. Patch damaged areas.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

E. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Field inspections and tests will be performed by an independent testing agency.

3.5 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 072700

AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air barriers.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Field Quality Control Submittals: Submit third-party reports of testing and inspection

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

J. Testing agency qualification statement.

1.3 QUALITY ASSURANCE

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.4 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.1 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier, Fluid Applied: Vapor semi-permeable, elastomeric waterproofing.

1. Air Barrier Membrane:
   a. Dry Film Thickness (DFT): 30 mil, 0.030 inch, minimum.
   b. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   c. Water Vapor Permeance: 11 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
   d. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
   e. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
   f. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
   g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
   h. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
   i. Products:
      1) Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech-VP: www.carlisleccw.com/#sle.
      2) Tremco Commercial Sealants & Waterproofing; ExoAir 230: www.tremcosealants.com/#sle.
      3) W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com/#sle.
      4) Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.

1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.

C. Primer: Liquid applied type as recommend by air barrier manufacturer.

D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.

E. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

F. Preformed Transition Membrane: Semirigid silicone or polyester composition, tapered edges, tear resistant.

1. Products:
   a. Dow; DOWSIL Silicone Transition Strip and System: www.dow.com/#sle.
   b. Henry Company; Moistop Corner Shield: www.henry.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing; ProGlaze ETA System 1: www.tremcosealants.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

G. Thinners and Cleaners: As recommended by material manufacturer.

H. Air and Moisture Sealing Insulation Fasteners: Preassembled fastener units consisting of sealing washer, screw, and gasketing tube.

1. Length as required for thickness of insulation material and penetration of deck substrate.
2. Thread and tip types as required for substrate material.
3. Products:
   a. TruFast Walls, a Division of Altenloh, Brinck & Co. US, Inc; Grip-Deck TubeSeal: www.trufastwalls.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Fluid-Applied Coatings or Membranes:

1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
2. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

E. Openings and Penetrations in Exterior Air Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Coordination of [**third party testing agency**] Tests and Inspections:

1. Provide testing and inspection required by [**third party testing agency**]
2. Notify [**third party testing agency**] in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with [**third party**] testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

D. Do not cover installed air barriers until required inspections have been completed.

E. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

F. Take digital photographs of each portion of installation prior to covering up air barriers.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 072726

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor-permeable, fluid-applied air barriers.

B. Sustainable Design Requirements: Refer to Section 018113 “Sustainable Design Requirements” for requirements affecting work of this section.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate with Section 014000 “Quality Requirements” for large scale mock-ups.
2. Refer to Section 014339 “Mockups” for more information regarding Mockups and how it affects this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace air barrier membrane that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Conform to applicable code for flame and smoke limitations including, but not limited to, NFPA 285; receive test documentation or engineering judgements acceptable to AHJ during Design Phase.

C. Building Envelope Airtightness: Test building airtightness to comply with ANSI/ASHRAE/IES Standard 90.1, section 5.9.2.2 with the following modifications/ additions:

1. Conduct testing in accordance with ASTM E779, ASTM E1827 or equivalent stand by an independent third party.
2. Measured leakage shall not exceed 0.25 cfm/SF under a pressure differential of 0.3 in. of water with air leakage rate normalized by the sum of above- and below- grade building envelope areas of the conditioned and semi-conditioned space.
3. Section 501.4.3.1.3(a), exception (1) is not allowed.
4. Section 501.4.3.1.3(a), exception (2) is allowed where the measured air leakage rate exceeds 0.25 cfm/sf but does not exceed 0.40 cfm/sf.

D. Low-Emitting Materials- Adhesives & Sealants: All adhesives and sealants used inside of the weatherproofing system and applied on site must comply with General Emissions Evaluation and VOC content requirements for wet applied products. Additionally, exterior applied products including adhesives, sealants, coatings, roofing and waterproofing materials applied on site must meet the VOC limits of California Air Resources Board (CARB) 2007. Suggested Control Measure for Architectural Coatings, and South Coast Air Quality Management District. (SCAQMD), Rule. 1168, effective July 1, 2005. Small containers of adhesives and sealants subject to state or federal consumer product VOC regulations are exempt. This strategy correlates to LEED Credit: Low-Emitting Materials.

2.2 AIR BARRIER, VAPOR PERMEABLE

A. Vapor-Permeable Air Barrier: Synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 30 mils or thicker over smooth, void-free substrates.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Carlisle Coatings & Waterproofing Inc.; Fire Resist Barritech VP
b. GCP Applied Technologies Inc.; Perm-A-Barrier or Perm-A-Barrier 20 LT.
c. Tremco Incorporated; Exoair 230
d. Henry Company; Air-Bloc 33MR.
e. Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
f. Sto Corp.; StoGuard AirSeal.

g. W.R. Meadows, Inc., Air-Shield LMP.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference when tested in accordance with ASTM E 2178.
b. Water Vapor Permeance: 14 perms when tested in accordance with ASTM E 96/E 96M, Method B.
c. Ultimate Elongation: Minimum 200 percent when tested in accordance with ASTM D 412.
d. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to six months of weather exposure.
e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.3 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Adhesives and Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Sprayed Polyurethane Foam Sealant: 1 or 2 component, foamed in place, polyurethane foam sealant, 1.5 to 2.0 lb/cu ft density; Flame spread index of 25 or less according to ASTM E162.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Do not cover air barrier until it has been tested and inspected by testing agency.

C. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Continuous structural support of air-barrier system has been provided.
4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
5. Site conditions for application temperature and dryness of substrates have been maintained.
6. Maximum exposure time of materials to UV deterioration has not been exceeded.
7. Surfaces have been primed, if applicable.

8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
9. Termination mastic has been applied on cut edges.
10. Strips and transition strips have been firmly adhered to substrate.
11. Compatible materials have been used.
12. Transitions at changes in direction and structural support at gaps have been provided.
13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
14. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

SECTION 074213.19

INSULATED METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Factory-assembled metal panel system for walls, with trim, related flashings and accessory components.

B. Secondary sub-girt framing system, attached to building structural frame.

1.2 PREINSTALLATION MEETING

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer documentation on tested structural, thermal, and fire resistance capabilities of assembled panel.

C. Shop Drawings: Indicate dimensions.

D. Samples: Submit two samples of panel, in manufacturer's standard size illustrating finish color, sheen, and texture.

E. Design and Performance Data: Indicate panel profile and dimensions.

F. Manufacturer's Installation Instructions: Indicate special handling criteria.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section approved by manufacturer.

1.5 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up, ____ feet long by ____ feet wide, including panels.

C. Demonstrate component assembly including panel and glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

D. Locate where directed.

E. Mock-up may remain as part of work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials that could cause discoloration or staining.

1.7 FIELD CONDITIONS

A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal plate wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Insulated Metal Wall Panels:

1. ATAS International, Inc.
2. Centria, a Nucor Company.
3. Kingspan Insulated Panels
4. Metl-Span, a Nucor Company.

2.2 PERFORMANCE / DESIGN CRITERIA

A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.

1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
2. Accommodate tolerances of building structural framing.
3. Provide continuity of air barrier seal at building enclosure elements in conjunction with air seal materials; see Section 072700.

B. Performance Requirements:

1. Thermal Performance: Provide thermal resistance through entire system; R-value of ___, minimum.
2. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
   a. Verify structural performance in accordance with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
   b. Design Wind Loads: Calculated in accordance with the 2018 International Building code.
   c. Maximum Allowable Deflection of Panel: 1/90 of span.
3. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
   a. Normal movement between system components.
   b. Seasonal temperature cycling.
   c. Deflection of structural support framing,

2.3 COMPONENTS

A. Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place or rigid board insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.

1. Panel Width: ___ inch.
2. Profile: _____; horizontal panels.
3. Panel Thickness: ___ inch.
4. Exterior Sheet: Pre-finished aluminum, 20 gauge, 0.032 inch minimum thickness; stucco embossed.

5. Interior Sheet: Aluminum, pre-finished, 20 gauge, 0.032 inch minimum thickness.
6. Panel Edge Profile: Tongue and groove, for flush seam.
7. Exterior Finish: Polyvinylidene fluoride (PVDF) coating; _____ color.
8. Interior Finish: Anodized, natural.

B. Internal and External Corners: Same material, thickness, and finish as exterior sheets; factory-fabricated mitered to required angles in one continuous piece with minimum 18 inch returns.

1. Profile: _____.

C. Trim, Closure Pieces, Expansion Joints, Caps, Flashings, Fascias, and Infills: Same material and finish as exterior sheets; factory-fabricated to required profiles; fabricated in longest practicable lengths.

1. Exposed Fasteners: Not permitted.
2. Profiles: To suit system.

2.4 MATERIALS

A. Rigid Board Insulation: Polyurethane. Surface Burning Characteristics as required.

B. Foamed-in-Place Insulation: Urethane type.

1. Compressive Strength: ____ psi, in accordance with ASTM D1621 test method.
2. Density: ____ lb/cu ft, in accordance with ASTM D1622 test method.
3. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

C. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient; ultraviolet and ozone resistant; color as selected by Architect.

2.5 ACCESSORIES

A. Support for Cladding and Continuous Insulation: Thermal clips.

1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing.
2. Clip Depth: As required for thickness of insulation.
3. Spacing of Clips: 16 inches on center, vertically.
4. Fasteners: As recommended by clip manufacturer.

D. Concealed Sealants: Non-curing butyl sealant or tape sealant.

E. Exposed Sealants: Approved for adhesions to materials adjacent to and in conjunction with metal wall panels.

F. Subgirts: As required for system design.

G. Anchors: Galvanized steel.

H. Fasteners: Manufacturer's standard type to suit application; hot-dip galvanized steel with soft neoprene washers; provide with fastener cap same color as exterior panel.

I. Field Touch-up Paint: As recommended by panel manufacturer.

J. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that structural framing is ready to receive panel system.

3.2 PREPARATION

A. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.3 INSTALLATION

A. Install panel system on walls in accordance with manufacturer's instructions.

B. Protect panel surfaces in contact with cementitious materials with bituminous paint; allow paint to dry prior to installation.

C. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.

D. Locate panel joints over supports.

E. Provide expansion joints where indicated.

F. Use concealed fasteners unless otherwise approved by Architect.

G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

3.5 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove site cuttings from finish surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

3.6 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Cover boards.

D. Flashings.

E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, insulation and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions and conditions of interface with other materials.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Specimen Warranty: For approval.

I. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.5 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

D. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.

C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.

1. Warranty Term: 20 years.
2. For repair and replacement include costs of both material and labor in warranty.
3. Exceptions are not Permitted:
   a. Damage due to roof traffic.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:

1. Carlisle SynTec Systems.
2. GAF: www.gaf.com/#sle.
3. Versico Roofing Systems.
4. Substitutions: See Section 016000 - Product Requirements.

B. Insulation:

1. Carlisle SynTec Systems.
2. GAF.

3. Versico Roofing Systems.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:

1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims.
   a. Thickness: 60 mil, 0.060 inch, minimum.
2. Sheet Width:
   a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
3. Color: As selected by Architect from manufacturer's full color range.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

2.3 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.

1. Thickness: As indicated on drawings, fire-resistant.
2. Products:
   a. Georgia-Pacific.
   b. Gold Bond Building Products, LLC.
   c. Substitutions: See Section 016000 - Product Requirements.

2.4 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

1. Classifications:
   a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
      2) Compressive Strength: Classes 1-2-3, Grade 3, 25 psi (172 kPa), minimum.
      3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F.
2. Board Size: 48 by 96 inches.
3. Board Thickness: 1.5 inches.
4. Tapered Board: Slope as indicated; fabricate of fewest layers possible.
5. Board Edges: Square.

2.5 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials; cants formed to 45 degree angle.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Insulation Adhesive: As recommended by insulation manufacturer.

G. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

H. Sealants: As recommended by membrane manufacturer.

I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.

1. Composition: Roofing membrane manufacturer's standard.
2. Size: Manufacturer's standard size.
3. Surface Color: White or Yellow.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.3 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.4 INSTALLATION - INSULATION, UNDER MEMBRANE

A. Attachment of Insulation:

1. Embed first layer of insulation in full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

C. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

D. Do not install more insulation than can be covered with membrane in same day.

E. Cover Boards: Adhesively fasten cover boards in accordance with roofing manufacturer's instructions.

3.5 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by the roofing manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:

1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.

2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and related flashings.

3.6 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.7 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 6 by 6 inches in size, illustrating metal finish color.

D. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.

1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
2. Color: As selected by Architect from manufacturer's standard colors.

B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
2. Color: As selected by Architect from manufacturer's standard colors.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and brake edges.

2.3 GUTTERS AND DOWNSPOUTS

A. See Section 077123 for manufactured gutters and downspouts.

2.4 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.5 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I, No. 15.

C. Primer Type: Zinc chromate.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Fenestration Perimeter Flashing Attachments: Two-piece flashing receiver and clip of extruded aluminum, at least 0.045 inch thick, for attaching flashing at perimeter of exterior wall fenestration openings.

1. Provide flashing receiver profile appropriate for flashing applications.
2. Products:
   a. York Manufacturing, Inc; AirSill Flashing Receivers.
   b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.3 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:

1. Secure receiver at perimeter of wall opening with adhesives or fasteners.
2. Place flashing into receiver channel.
3. Secure flashing with receiver clip.

E. Seal metal joints watertight.

END OF SECTION

SECTION 077100

ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured roof specialties, including copings and roof edge flashings.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

1. Accessories that require modifications to roof assembly installation should be detailed accordingly in corresponding shop drawings.

D. Samples: Submit two appropriately sized samples of coping and expansion joint cover.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

F. Provide manufacturer compliance letter signed by roofing manufacturer stating that materials and units supplied comply with project requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Roof Edge Flashings and Copings:

1. Architectural Products Co.
2. ATAS International, Inc.
3. Drexel Metals Inc.
4. Hickman Edge Systems.
5. Metal-Era Inc.
6. Metal Roofing Systems, Inc.
7. Substitutions: See Section 016000 - Product Requirements.

2.2 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.

1. Configuration: Edge securement for roof membrane.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by

applicable local building code.
3. Exposed Face Height: As indicated on drawings.
4. Material: Formed aluminum sheet, 0.050 inch thick, minimum.
5. Finish: 70 percent polyvinylidene fluoride.
6. Color: As selected by Architect from manufacturer's standard range.

B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Wall Width: As indicated on drawings.
4. Outside Face Height: As indicated on drawings.
5. Inside Face Height: As indicated on drawings.
6. Material: Formed aluminum sheet, 0.040 inch thick, minimum.
7. Finish: 70 percent polyvinylidene fluoride.
8. Color: As selected by Architect from manufacturer's standard range.

2.3 FINISHES

A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturer's standard colors.

2.4 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

1. See Section 077200 for information on roofing related accessories.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

END OF SECTION

SECTION 077123

MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Comply with applicable code for size and method of rain water discharge.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Gutters and Downspouts:

1. ATAS International, Inc.
2. Cheney Flashing Company.
3. Drexel Metals Inc.
4. Hickman Edge Systems.
5. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc.
6. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209/B209M; 0.032 inch thick.

1. Finish: Plain, shop pre-coated with modified silicone coating.
2. Color: As indicated.

B. Primer: Zinc molybdate type.

C. Protective Backing Paint: Zinc molybdate alkyd.

2.3 COMPONENTS

A. Gutters: D-Style.

B. Downspouts: Smooth box profile.

C. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: In accordance with SMACNA requirements.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets.

D. Fasteners: Galvanized steel, with soft neoprene washers.

2.4 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.5 FINISHES

A. Modified silicone polyester coating: Baked enamel system, comply with AAMA 2603.

2.6 ACCESSORIES

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.

1. Configuration: Angular.
2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
3. Finish: Manufacturer's standard factory applied powder coat finish.
4. Color: To be selected by Architect from manufacturer's standard range.
5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and rubber coupling.
6. Products:
   a. Downspoutboots.com, a division of J. R. Hoe & Sons.

b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.2 PREPARATION

A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.3 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Connect downspouts to storm sewer system. Grout connection watertight.

END OF SECTION

SECTION 077200

ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof curbs.

B. Equipment supports.

C. Roof penetrations mounting curbs.

D. Pipe and duct supports.

E. Preformed flashing sleeves.

F. Roof hatches.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1. Accessories that require modifications to roof assembly installation should be detailed accordingly in corresponding shop drawings.
2. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
3. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:

1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.3 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer's standard warranty. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs Manufacturers:

1. AES Industries Inc.
2. The Pate Company.
3. LMCurbs.
4. MKT Metal Manufacturing.
5. Substitutions: See Section 016000 - Product Requirements.

B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.

1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
2. Roof Curb Mounting Substrate: Curb substrate consists of flat roof deck sheathing with insulation.
3. Sheet Metal Material:
   a. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gauge, 0.048 inch thick.
4. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing system at 1:1 slope; minimum cant height 4 inches.
5. Provide layouts and configurations indicated on drawings.

C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.
2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
3. Height Above Finished Roof Surface: 8 inches, minimum.

D. Equipment Support: Straight curbs on each side of equipment, with top of curbs parallel with metal roofing system and each other for equipment mounting.

1. Height Above Metal Roofing System: 12 inches, minimum.

E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.2 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated

on Drawings; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers:
   a. Pate Company (The).
   b. Roof Products, Inc.
   c. Thybar Corporation.
   d. Substitutions: See Section 016000 - Product Requirements.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch thick.

1. Finish: Baked enamel or powder coat.
2. Color: As selected by Architect from manufacturer's full range.

D. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
6. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.3 PIPE AND DUCT SUPPORTS

A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded-aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.

1. Manufacturers:
   a. Thaler Metal USA Inc.
   b. Substitutions: See Section 016000 - Product Requirements.
2. Pipe Support Height: As indicated on Drawings.
3. Roller Assembly: With stainless-steel roller, sized for supported pipes.
4. Pipe Support Flashing: Manufacturer's standard insulated sleeve flashing with integral base flange.
5. Finish: Manufacturer's standard.

B. Light-Duty Pipe Supports: Extruded-aluminum base assembly and Type 304 stainless-steel roller assembly for pipe sizes indicated, including manufacturer's recommended load-distributing baseplate.

1. Manufacturers:
   a. Thaler Metal USA Inc.

b. Substitutions: See Section 016000 - Product Requirements.

2. Finish: Manufacturer's standard.

C. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

1. Manufacturers:
   a. Thaler Metal USA Inc.
   b. Substitutions: See Section 016000 - Product Requirements.
2. Finish: Manufacturer's standard

2.4 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

1. Manufacturers:
   a. Custom Solution Roof and Metal Products.
   b. Thaler Metal USA Inc.
   c. Substitutions: See Section 016000 - Product Requirements.
2. Metal: Aluminum sheet, 0.063 inch thick.
3. Diameter: As indicated, if not indicated as directed by Architect.
4. Finish: Manufacturer's standard.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers:
   a. Custom Solution Roof and Metal Products.
   b. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   c. Thaler Metal USA Inc.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Metal: Aluminum sheet, 0.063 inch thick.
3. Height: 13 inches.
4. Diameter: As indicated, if not indicated as directed by Architect.
5. Finish: Manufacturer's standard

2.5 ROOF HATCHES

A. Roof Hatch Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries.
2. Babcock-Davis.
3. Bilco Company.
4. Substitutions: See Section 016000 - Product Requirements.

B. Roof Hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.

1. Style: Provide flat metal covers unless otherwise indicated.
2. Mounting Substrate: Provide frames and curbs suitable for mounting on flat roof deck sheathing with insulation.
3. Mounting: Provide frames and curbs suitable for mounting conditions as indicated on drawings.
4. Thermally Broken Hatches: Provide insulation within frame and cover.

5. Size: As indicated on drawings; single-leaf style unless otherwise indicated.

C. Metal Covers: Flush, insulated, hollow metal construction.

1. Capable of supporting 40 psf live load.
2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch thick, liner 0.04 inch thick.
3. Insulation: Manufacturer's standard 2 inches rigid glass fiber.
4. Gasket: Neoprene, continuous around cover perimeter.

D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.

1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
2. Hinges: Heavy duty pintle type.
3. Hold open arm with vinyl-coated handle for manual release.
4. Latch: Upon closing, engage latch automatically and reset manual release.
5. Manual Release: Pull handle on interior.
6. Locking: Padlock hasp on interior.

2.6 NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES

A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.

1. Design Loadings and Configurations: As required by applicable codes.
2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
6. Products:
   a. Garlock Safety Systems.
   b. Metal Roof Innovations, Ltd. S-5! Attachment Solutions.
   c. PHP Systems/Design.
   d. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. See Section 077100 for information on roof specialties.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

B. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

C. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

D. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions

3.4 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 079200

JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Silicone joint sealants.

B. Urethane joint sealants.

C. Mildew-resistant joint sealants.

D. Butyl joint sealants.

E. Latex joint sealants.

F. Spray foam sealants

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

C. Manufacturer's qualification statement.

D. Installer's qualification statement.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 SILICONE SEALANTS

A. Basis-of-Design Product: Provide products by Tremco Incorporated, or equal products by one of the following:

1. Dow Corning Corporation.
2. GE Construction Sealants; Momentive Performance Materials Inc.
3. Pecora Corporation.
4. Sherwin-Williams Company (The).
5. Substitutions: See Section 016000 - Product Requirements.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Basis of Design Product: Tremco Incorporated; Spectrem 2.
2. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Locations:
      1) Glazing.
      2) Metal to metal.
      3) Metal to masonry.
      4) Joints between different materials listed above.
   b. Perimeter joints between materials listed above and frames of doors, windows and louvers.
      1) Control and expansion joints in ceilings and other overhead surfaces.
      2) Other joints as indicated on Drawings.
   c. Joint-Sealant Color: As selected by Architect.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

1. Basis-of-Design Product: Provide products by Tremco Incorporated, or equal products by one of the following:
   a. Dow Corning Corporation.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   c. Pecora Corporation.
   d. Substitutions: See Section 016000 - Product Requirements.

B. Silicone, Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Basis of Design: Tremco Incorporated; Spectrem 3; low modulus.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Perimeter joints between frames of doors, windows and louvers.
   b. Other joints as indicated on Drawings.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Perimeter joints between frames of doors, and windows.
   b. Control and expansion joints in ceilings and other overhead surfaces.
   c. Other joints as indicated on Drawings.

E. Joint-Sealant Color: As selected by Architect.

2.3 URETHANE JOINT SEALANTS - NONTRAFFIC

A. Basis-of-Design Product: Provide products by Tremco Incorporated, or equal products by one of the following:

1. BASF Corp. - Construction Chemicals.
2. Down Corning Corporation.
3. GE Construction Sealants; Momentive Performance Materials Inc.
4. Pecora Corporation.
5. Sherwin-Williams Company (The).
6. Substitutions: See Section 016000 - Product Requirements.

B. Urethane, Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Basis of Design: Tremco Incorporated; Vulkem 116.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Tile control and expansion joints.
   c. Vertical joints on exposed surfaces of unit masonry, concrete and partitions.
   d. Other joints as indicated on Drawings.

D. Joint-Sealant Color: As selected by Architect.

2.4 URETHANE JOINT SEALANTS - TRAFFIC

A. Basis-of-Design: Provide products by Tremco Incorporated, or equal products by one of the following:

1. BASF Corp. - Construction Chemicals.
2. Dow Corning Corporation.
3. GE Construction Sealants; Momentive Performance Materials Inc.
4. Pecora Corporation.
5. Sherwin-Williams Company (The).
6. Substitutions: See Section 016000 - Product Requirements.

B. Urethane, Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Basis of Design: Tremco Incorporated; Dymonic 100

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated on Drawings.

D. Joint-Sealant Color: As selected by Architect.

2.5 URETHANE JOINT SEALANTS - POURABLE TRAFFIC AND NONTRAFFIC

A. Basis-of-Design: Provide products by Tremco Incorporated, or equal products by one of the following:

1. BASF Corp. - Construction Chemicals.
2. GE Construction Sealants; Momentive Performance Materials Inc.
3. Pecora Corporation.
4. Sherwin-Williams Company (The).
5. Substitutions: See Section 016000 - Product Requirements.

B. Urethane, Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 35, Uses T and NT.

1. Basis of Design: Tremco Incorporated; Vulkem445SSL.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Tile control and expansion joints.
   c. Joints between different materials listed above.
   d. Other joints as indicated on Drawings.

D. Joint-Sealant Color: **As selected by Architect.**

2.6 MILDEW-RESISTANT JOINT SEALANTS

A. Silicone, Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Basis-of-Design: Provide products by Tremco Incorporated, or equal products by one of the following:
   a. BASF Corp. - Construction Chemicals.
   b. Dow Corning Corporation.
   c. GE Construction Sealants; Momentive Performance Materials Inc.
   d. Pecora Corporation.
   e. Sherwin-Williams Company (The).
   f. Substitutions: See Section 016000 - Product Requirements.
2. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   a. Joint Locations:
      1) Joints between plumbing fixtures and adjoining walls, floors, and counters.
      2) Tile control and expansion joints where indicated.
      3) Other joints as indicated on Drawings.

B. Joint-Sealant Color: As selected by Architect.

2.7 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Basis-of-Design: Provide TremPro JS-773 by Tremco Incorporated, or equal products by one of the following:
   a. Bostik, Inc.; Chem-Calk 300.
   b. Pecora Corporation; BC-158.
   c. Substitutions: See Section 016000 - Product Requirements.
2. Joint-Sealant Application: Concealed mastics.
   a. Joint Locations:
      1) Aluminum thresholds.
      2) Sill plates.
      3) Other joints as indicated on Drawings.
   b. Joint-Sealant Color: Off-white.

2.8 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Basis-of-Design: Provide Tremflex 834 by Tremco Incorporated, or equal products by one of the following:
   a. BASF Corp. - Construction Chemicals.
   b. Dow Corning Corporation.
   c. GE Construction Sealants; Momentive Performance Materials Inc.
   d. Pecora Corporation.
   e. Sherwin-Williams Company (The).
   f. Substitutions: See Section 016000 - Product Requirements.
2. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
   a. Joint Locations:
      1) Control joints on exposed interior surfaces of exterior walls.
      2) Perimeter joints between interior wall surfaces and frames of interior doors and windows.
      3) Other joints as indicated on Drawings.

B. Joint-Sealant Color: As selected by Architect.

2.9 SPRAY FOAM SEALANTS

A. Basis-of-Design: Provide TremGlaze Low Expansion Polyurethane Foam Sealant by Tremco Incorporated, or equal products by one of the following:

1. Dow Corning Corporation.
2. Substitutions: See Section 016000 - Product Requirements.

2.10 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

3. Open Cell: 40 to 50 percent larger in diameter than joint width.
4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
5. Manufacturers:
   a. Adfast USA Inc.
   b. Nomaco, Inc.
   c. Substitutions: See Section 016000 - Product Requirements.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

D. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

C. Install bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

G. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Thermally insulated hollow metal doors with frames.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Fleming Door Products, an Assa Abloy Group company.
2. Krieger Specialty Products.
3. Mesker, dormakaba Group.
4. Republic Doors, an Allegion brand.
5. Technical Glass Products.
6. Titan Metal Products, Inc.
7. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.

C. Interior Doors, Non-Fire-Rated:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
3. Weatherstripping: Separate, see Section 087100.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.

E. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.

F. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

G. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 ACCESSORIES

A. Glazing: As specified in Section 088000, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 087100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

D. Coordinate installation of electrical connections to electrical hardware items.

3.4 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 081416

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flush wood doors; flush configuration; non-rated.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door construction, 12 by 12 inches in size cut from top corner of door including wood veneer specie, stain color and sheen.

E. Manufacturer's Installation Instructions: Indicate special installation instructions.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Specimen warranty.

I. Warranty, executed in Owner's name.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Krieger Specialty Products.
2. Oregon Door.
3. VT Industries, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

2.3 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type structural composite lumber core (SCLC), plies and faces as indicated.

2.4 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.5 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

1. Exception: Doors to be field finished.

E. Provide edge clearances in accordance with the quality standard specified.

2.6 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:
   a. System - 11, Polyurethane, Catalyzed.
   b. Stain: As selected by Architect.
2. Opaque:
   a. System - 11, Polyurethane, Catalyzed.
   b. Color: As selected by Architect.

2.7 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

3.3 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 083100

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Samples: Submit two full size access units,of each type required, indicating frame configuration.

E. Manufacturer's Installation Instructions: Indicate installation requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Project Record Documents: Record actual locations of each access unit.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

2.2 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:

1. ACUDOR Products Inc.
2. Karp Associates, Inc.
3. Nystrom, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate

requirements with type of installation assembly being used for each unit.

1. Material: Steel.
2. Style: Exposed frame with door surface flush with frame surface and doors with concealed flanges .
3. Door Style: Single thickness with rolled or turned in edges.
4. Frames: 16-gauge, 0.0598-inch minimum thickness.
5. Single Steel Sheet Door Panels: 16-gauge, 0,0625-inch minimum thickness.
6. Double-Skinned Hollow Steel Sheet Door Panels: 16-gauge, 0.059-inch minimum thickness, on both sides and along each edge.
7. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.
8. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
   a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
   b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
9. Steel Finish: Primed.
10. Door/Panel Size: As indicated on the drawings.
11. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Latch/Lock: Screw driver slot for quarter turn cam latch.
    d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

C. GFRG Access Doors with Concealed Flanges:

1. Manufacturers:
   a. Karp Associates.
   b. Glendon Company.
   c. ACUDOR Products Inc.
2. Description: Door, flush with frame, with concealed flanges.
3. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
4. Latch and Lock: Screw driver slot for quarter turn cam latch.
5. Gasketing: Provide extruded neoprene, around perimeter of door panel at exterior installations.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 083323

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior coiling doors.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general construction, component connections and details, and _____.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Two slats, 12 inches in length illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Overhead Coiling Metal Doors:

1. C.H.I. Overhead Doors.
2. Cornell Iron Works, Inc.
3. Wayne-Dalton, a Division of Overhead Door Corporation.

2.2 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.

1. Capable of withstanding positive and negative wind loads of 20 psf without undue deflection or damage to components.
2. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place polyurethane insulation; minimum R-value of 4.88.
3. Nominal Slat Size: 3 inches wide by required length.
4. Finish: Galvanized.
5. Guide, Angles: Galvanized steel.
6. Hood Enclosure: Manufacturer's standard; primed steel.
7. Manual hand chain lift operation.
8. Mounting: Within framed opening.

2.3 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.

1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
3. Steel Slats: ASTM A653/A653M galvanized steel sheet.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.

1. Hot-dip galvanized in compliance with ASTM A123/A123M.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

E. Lock Hardware:

1. Manual Chain Lift: Provide padlockable chain keeper on guide.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that adjacent construction is suitable for door installation.

B. Verify that door opening is plumb, header is level, and dimensions are correct.

C. Notify Architect of any unacceptable conditions or varying dimensions.

D. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Install enclosure and perimeter trim.

3.3 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.
b. Folding doors.
c. Other doors to the extent indicated.

B. Related Sections include the following:

1. Division 8 Section "Steel Doors and Frames"
2. Division 8 Section "Flush Wood Doors"
3. Division 8 Section "Aluminum Entrances and Storefronts"
4. Division 8 Section "Power Door Operators" for automatic door operators.

1.3 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. System schematic.
b. Point-to-point wiring diagram.
c. Riser diagram.
d. Elevation of each door.

2. Detail interface between electrified door hardware and access fire alarm, control, and security building control system.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

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1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

    a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

        1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
5. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

E. Keying Schedule: Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

F. Product Certificates: Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.

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1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

I. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

J. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Electrified Door Hardware Supplier Qualifications: An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

a. Engineering Responsibility: Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Qualifications: Experienced in providing consulting services for electrified door hardware installations.

D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical

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modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards**,"** as follows:

   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
   b. Door Closers: Comply with the following maximum opening-force requirements indicated:

      1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

   c. Thresholds: Not more than 1/2 inch high, Not more than 3/4 inch high for exterior sliding doors. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 3 seconds.
   c. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
   d. Thresholds: Not more than 1/2 inch high.

3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

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I. All Electric Door Hardware shall be furnished and installed by the General Contractor. All Electric Door Hardware shall be wired by the Electrical Contractor. Both the Electrical & General Contractor shall meet and coordinate all work before proceeding.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item with Door Number related to the final Approved Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to manufacturer of key control system, or Owner as Directed.

D. Deliver keys to Owner by registered mail or overnight package service.

1.6 COORDINATION

A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

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B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of operators and door hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

C. Warranty Period for Locksets: Ten, (10) years from date of Substantial Completion, unless otherwise indicated.

D. Warranty Period for Manual Closers: Twenty-Five, (25) years from date of Substantial Completion, unless otherwise indicated.

E. Warranty Period for Exit Devices: Ten, (10) years from date of Substantial Completion, unless otherwise indicated.

F. Warranty Period for Electrical Exit Devices: Two, (2) years from date of Substantial Completion, unless otherwise indicated.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

C. Engage a factory authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section**,** door hardware sets indicated in door and frame schedule, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products**.** Retain subparagraph below for electrified door hardware.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

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B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Butt Hinges:
   a. Best Hinge Company, Inc.
   b. Hager Hinge Company, Inc.
   c. Bommer Hinge Company, Inc.

2. Continuous Hinges:

   a. Architectural Builders Hardware Mfg., Inc.
   b. Best Hinge Company, Inc.
   c. National Guard Products, Inc.

B. Standards: Comply with the following:
1. Hinges ANSI/BHMA Standard A156.1 Grade 1
2. Continuous Hinges ANSI/BHMA Standard A156.26 Grade 1

C. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

D. Concealed bearings are made from engineered polymer material with PTFE and Aramid fiber; bearing is maintenance free, no oil, no grease.

E. Butt hinges equipped with easily seated, non-rising pin. Hole in bottom of pin enables quick pin removal for ease of installation.

F. Continuous hinge material to be 14 gauge, 304 stainless steel.

G. Continuous hinge steel pin to be .25 diameter, 304 stainless steel.

H. Continuous hinge exterior barrel diameter .438 (7/16)

I. Continuous hinge knuckle to be 2”, including split nylon bearing at each separation for a quiet, smooth, self-lubricating operation

J. All hinges to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours

K. Continuous hinges to have Symmetrically templated hole pattern

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L. Continuous hinge to have a 10 year Warranty

M. Hinge Weight: Unless otherwise indicated, provide the following:
1. Supports weights up to 600lbs.

N. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Continuous Hinges: Stainless steel, with stainless-steel pin,
2. Interior Continuous Hinges: Stainless steel, with stainless-steel pin.
3. Continuous Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.
4. Exterior Butt Hinges: Stainless Steel or Brass or Bronze
5. Interior Butt Hinges: Steel or Brass or Bronze

O. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:

1. Hospital Tips: Slope ends of hinge barrel.
2. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
3. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

a. Outswinging exterior doors.
b. Outswinging corridor doors with locks.

P. Continuous-Geared Aluminum Hinges: Minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame. Finish components after milling and drilling are complete. Fabricate hinges to template screw locations.

Q. All geared hinges to be heavy-gauge aluminum alloy with solid support blocks of self-lubricating DELRIN.

R. All geared hinges to meet Dynamic and static load test for compliance with ANSI A156.1, (BHMA) for 350,000 cycles at 15 cycles per minute.

S. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head screws; machine screws drilled and tapped holes for metal doors, wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:
a. Best Locking Systems, Inc., First Energy Stadium Standard

B. Standards: Comply with the following:

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1. Bored Locks and Latches: BHMA A156.2.
2. Mortise Locks and Latches: BHMA A156.13.

C. Bored Locks: ANSI A156.2, BHMA Series 4000, Grade 1, and is UL Listed.

D. Mortise Locks: Stamped steel case with steel or brass parts; ANSI A156.13, Series 1000, BHMA Grade 1 Operational and Grade 2 Security and be UL Listed.

E. Certified Products: Provide door hardware listed in the following BHMA directories:

1. Mechanical Locks and Latches: BHMA's "Directory of Certified Locks & Latches."
2. Electromagnetic Locks: BHMA's "Directory of Certified Electromagnetic & Delayed Egress Locks."

F. Lock Trim: Comply with the following:

1. Lever: Mortise Locks & Latches, Forged or Cast brass, bronze or stainless steel construction

2. Lever: Cylindrical Locks & Latches, Zinc material with a minimum wall thickness of .060
3. Dummy Trim: Match lever lock trim and escutcheons.

G. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule comply with the following:

1. Bored Locks: BHMA A156.2.
2. Mortise Locks: BHMA A156.13.

H. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Bored Locks: Minimum 9/16-inchlatch bolt throw.
2. Mortise Locks: Minimum 3/4-inchlatch bolt throw.
3. Deadbolts: Minimum 1-inchbolt throw.

I. Backset: 2-3/4 inches, unless otherwise indicated.

J. Mortise Locks & Latches shall have an anti-friction, 3/4-inch throw latch bolt with anti-friction piece made of self-lubricated stainless steel. Latch bolt with plastic insert and three-piece latch bolt are unacceptable on this project.

K. Mortise Locks & Latches shall have levers to be operated with a roller bearing spindle hub mechanism.

L. Cylindrical Locks & Latches to have solid shank with no opening for access to keyed lever keeper.

2.4 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Bolts:

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a. Triangle Brass Manufacturing Company, Inc.
b. Burns Manufacturing, Inc.
c. Hager Company, Inc.

B. Standards: Comply with the following:

1. Automatic and Self-Latching Flush Bolts: BHMA A156.3.
2. Manual Flush Bolts: BHMA A156.16.

C. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

D. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:

1. Mortise Flush Bolts: Minimum 3/4-inch throw.

2.5 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Precision Manufacturing, Inc.
2. Dormakaba Manufacturing, Inc.
3. Commercial Hardware, Inc.

B. Standard: BHMA A156.3.

1. BHMA Grade: Grade 1

C. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Exit device shall be “touch pad” type with a touch pad that shall extend a minimum of one half (1/2) of the door width.

G. Exit device lock stile chassis shall be investment cast steel. Stamped steel units will not be accepted. All device latch bolts shall be stainless steel and shall be deadlocking type.

H. Exit device strikes shall be adjustable type investment cast stainless steel.

I. Exit device shall include sound reduction dampening for both depression and extension of the touch pad.

J. Exit device end cap shall be all metal and secured with a bracket that interlocks both at the touch bar channel base and hinge side filler to prevent end cap “peel-back”.

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K. All exposed surfaces of the exit device housing shall be no less than 14 gauge brass or bronze; or no less than 16 gauge stainless steel. Aluminum housing type exit devices are not acceptable.

L. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

1. Operation: Rigid

M. Outside Trim: Lever, Lever with cylinder, Pull, Pull with cylinder**,** material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

2.6 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cylinders:
   a. Best Locking Systems, Inc., First Energy Stadium Standard, No Substitution
   b. All cylinders shall be Cormax 7-pin interchangeable cores.

B. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.

C. Cylinder Grade: BHMA Grade 1**,** Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's locksets.

E. Construction Keying: Comply with the following:

1. Construction Cores: Provide Brass construction cores in all locksets and cylinders that are replaceable by permanent cores.

   a. Replace Brass construction cores with permanent cores, as indicated in keying schedule.

F. Keying System: Unless otherwise indicated, provide a factory-registered keying system complying with the following requirements:

1. No Master Key System: Cylinders are operated by change keys only.
2. Master Key System: Cylinders are operated by a change key and a master key.

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3. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
4. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
5. Existing System: Master key or grand master key locks to Owner's existing system.
6. Keyed Alike: Key all cylinders to the same change key.

G. Keys: Provide nickel-silver keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

   a. Notation: **"DO NOT DUPLICATE."**

2. Quantity: In addition to one extra blank key for each lock, provide the following:

   a. Cylinder Change Keys: Three.
   b. Master Keys: Five.
   c. Grand Master Keys: Five.
   d. Great-Grand Master Keys: Five.
   e. Control Keys: Five
   f. Construction Master Keys: Ten
   g. Construction Core Control Keys: Five

2.7 STRIKES

A. Standards: Comply with the following:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

B. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latch bolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

C. Dustproof Strikes: BHMA Grade 1

2.8 OPERATING TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Triangle Brass Manufacturing Company, Inc.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate from aluminum, brass, bronze, stainless steel, unless otherwise indicated.

2.9 ACCESSORIES FOR PAIRS OF DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Coordinators:

a. Triangle Brass Manufacturing Company, Inc.
b. Burns Manufacturing Company, Inc.

2. Removable Mullions:

a. Dormakaba USA, Inc.
b. Precision, Inc.

3. Astragals:

a. Architectural Builders Hardware, Inc.
b. National Guard Products, Inc.

B. Standards: Comply with the following:

1. Coordinators: BHMA A156.3.
2. Removable Mullions: BHMA A156.3.

C. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

2.10 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Surface-Mounted Closers:

a. Dormakaba USA, Inc.
b. Commercial Hardware, Inc.
c. Best Door Closers, Inc.

B. Standards: Comply with the following:

1. Closers: BHMA A156.4.

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C. Surface Closers: BHMA Grade 1

D. Certified Products: Provide door closers listed in BHMA's "Directory of Certified Door Closers."

E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.11 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Protective Trim Units:

a. Triangle Brass Manufacturing Company, Inc.
b. Burns Manufacturing Company, Inc.

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
1. Stainless Steel: 0.050 inch thick; beveled 4 sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 2” less than door width on push side and 1” less than door width on pull side, by height specified in Door Hardware Schedule.

2.12 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Builders Hardware Mfg., Inc.
2. Triangle Brass Manufacturing Company, Inc.

B. Standards: Comply with the following:

1. Stops and Bumpers: BHMA A156.16.
2. Mechanical Door Holders: BHMA A156.16.
3. Electromagnetic Door Holders: BHMA A156.15.
4. Combination Overhead Holders and Stops: BHMA A156.8.
5. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1

D. Mechanical Door Holders: BHMA Grade 1

E. Combination Overhead Stops and Holders: BHMA Grade 1

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F. Electromagnetic Door Holders for Labeled Fire Door Assemblies: Coordinate with fire detectors and interface with fire alarm system.

G. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.13 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Door Gasketing:

a. National Guard Products, Inc.
b. Reese Manufacturing Co., Inc.

2. Door Bottoms:

a. National Guard Products
b. Reese Manufacturing Co., Inc.

B. Standard: Comply with BHMA A156.22.

C. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

D. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

E. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

F. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

G. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

H. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

I. Gasketing Materials: Comply with ASTM D 2000 and AAMA 701/702.

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2.14 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. National Guard Products, Inc.
2. Reese Manufacturing Co., Inc.

B. Standard: Comply with BHMA A156.21.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

a. Mortise hinges to doors.
b. Strike plates to frames.
c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:

a. Surface hinges to doors.
b. Closers to doors and frames.
c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.
5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

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2.16 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
2. BHMA 628: Satin aluminum, clear anodized, over aluminum base metal.
3. BHMA 630: Satin stainless steel, over stainless-steel base metal.
4. BHMA 652: Satin chromium plated over nickel, over steel base metal.
5. BHMA 689: Aluminum painted, over any base metal.
6. BHMA 693: Black Coated
7. BHMA 622: Flat Black Coated

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

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1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule. Supply key cabinet with 25% expansion. Factory install keys in cabinet or in field with owner's representative. Key cabinet to be supplied with a "Complete System" equal to the Telkee System.

D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings, in equipment room. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.
2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner or Architect will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

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1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:

1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

END OF SECTION 08 71 00

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SECTION 088000

GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Laminated glass interlayers.

D. Glass coatings.

E. Glazing compounds.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
   a. Insulating Glass Certification Council (IGCC).
   b. Safety Glazing Certification Council (SGCC).

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1. Provide company, field supervisors, and installers that hold active ANSI accredited certifications in appropriate categories for work specified.

1.4 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

D. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Float Glass Manufacturers:

B. Float Glass Manufacturers:

1. Cardinal Glass Industries.
2. Guardian Glass, LLC.
3. Pilkington North America Inc.
4. Saint Gobain North America.
5. Vitro Architectural Glass (formerly PPG Glass).
6. Substitutions: See Section 016000 - Product Requirements.

C. Laminated Glass Manufacturers:

1. Cardinal Glass Industries.
2. Tecnoglass.
3. Thompson I.G., LLC.
4. Viracon, Architectural Glass segment of Apogee Enterprises, Inc.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with applicable codes.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on canopy, sloping overhead, or other demanding applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with industry established testing requirements.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.4 INSULATING GLASS UNITS

A. Manufacturers:

1. Glass: Any of the manufacturers specified for float glass.
2. Substitutions: See Section 016000 - Product Requirements.

B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

C. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Aluminum.

5. Edge Seal:
   a. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.
   b. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.
7. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
   a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.

D. Insulating Glass Units: Vision glass, double glazed.

1. Basis of Design Manufacturer: Provide insulated glass manufactered by Guardian Glass LLC.
2. Applications: Exterior glazing unless otherwise indicated.
3. Space between lites filled with air or argon gas.
4. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-E (passive type), on #2 surface.
5. Metal edge spacer.
6. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
7. Total Thickness: 1 inch.
8. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.27, nominal.
9. Visible Light Transmittance (VLT): 31 percent, nominal.
10. Solar Heat Gain Coefficient (SHGC): 0.18, nominal.

2.5 LAMINATED GLASS INTERLAYERS

A. Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing:

1. Functionality: Post-breakage safety and security.
2. Applications:
   a. Single pane, laminated glass unit.
3. Color: Clear.
4. Thickness: As required for indicated performance of laminated glass application.

2.6 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.7 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

F. Carefully trim protruding tape with knife.

3.6 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.7 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points and install glazing pane or unit.

C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.

D. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.

E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.8 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.

1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.10 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

F. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.

G. Carefully trim protruding tape with knife.

3.11 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.12 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 088300

MIRRORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass mirrors.

1. Tempered safety glass.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Mirrors:

1. Binswanger Mirror/ACI Distribution.
2. Dreamwalls by Gardner Glass Products.
3. Lenoir Mirror Co.
4. Trulite Glass and Aluminum Solutions.
5. Walker Glass Company Ltd.
6. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, tempered safety glass; ASTM C1048, with copper and silver coatings, and protective overcoating.

1. Thickness: 1/4 inch.
2. Edges: Flat polished.
3. Size: As indicated on drawings.

2.3 ACCESSORIES

A. Mirror Attachment Accessories: Provide C.R. Laurence Co., In., CRL Mirraco Mirror Hanger, nickel plated finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.2 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.3 CLEANING

A. Remove labels after work is complete.

B. Clean mirrors and adjacent surfaces.

END OF SECTION

SECTION 089110

ACOUSTICAL EQUIPMENT SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acoustical equipment screens at roof top mechanical units.

1.2 SUBMITTALS

A. See Section 013000-Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product specifications.

C. Shop Drawings: For panels and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

D. Samples: For each type of metal finish required.

E. Delegated Design Submittal: For panels indicated to comply with structural and seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Sample Warranties: For manufacturer's special warranties.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.5 DELIVERY, STORAGE AND HANDLING

A. Materials to be in original containers with seals unbroken and labels intact until time of use. Wrapped or bundled materials will bear name of manufacturer and product. Damaged or otherwise unsuitable material, when so ascertained, will be removed from project site.

B. Store products in secure, dry location, out of way of construction operations. Store products off ground and protect from elements. Wetting of elements not permitted.

C. Prevent damage to materials, to other stored products, to existing construction, and project work.

1.6 WARRANTY

A. See Section 017800-Closeout Submittals for additional warranty requirements.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design panels, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Panels withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of panel components, noise or metal fatigue, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.

1. Wind Loads:
   a. Determine loads based on pressures indicated on Drawings.

C. Seismic Performance:

1. Panels, including attachments to other construction, withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

D. Acoustical Performance:

1. Minimum NRC (Noise Reduction Coefficient) rating of 0.95 and minimum STC (Sound Transmission Class) of 50 after panel fabrication.
2. All tests for validation of barrier panel performance for compliance with these specifications will be conducted by an independent NVLAP certified testing laboratory, National Institute of Standards (NIST) accredited to the most current standard of testing. At a minimum the testing results must conform and be tested to ASTM E90 and ASTM E413.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 ACOUSTICAL PANELS

A. Acoustic Performance: Provide acoustical panels complying with ratings specified, as demonstrated by testing manufacturer's stock units identical to those specified, except for length and width for airborne sound-transmission loss in accordance with ASTM E90 and E413 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

B. Acoustical Panel: Panel with formed-metal blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet of same material and finish.

1. Basis of Design Product: Subject to compliance with requirements, provide QuietMod H/H 50 Barrier Panels manufactured by Noise Barriers or a comparable product by one of following:
   a. Kinetics Noise Control Inc.
   b. RoofScreen Mfg.
   c. Parklane Mechanical Acoustics.
   d. Substitutions: See Section 016000-Product Requirements.
2. Panel Thickness: 4 inches.
3. Panel Material:
   a. Exterior Surfaces: Solid sheet, 16-gage galvanized steel.
   b. Interior Surfaces: 22 gage perforated galvanized steel.
   c. Sound Retarding Core: Sound-retarding and absorbing fill material shall be noncombustible, inert mildew-resistant and vermin proof.
4. Airborne Sound-Transmission Loss: STC 50 in accordance with ASTM E413, determined by testing in accordance with ASTM E90.
5. All accessory trim items to be 18 gage minimum galvanized steel, Type G90 and will be furnished in factory standard lengths to be field cut to specified dimensions. Location and quantity of sheet metal screws and trim requirements will be in accordance with the panel system manufacturer's installation details.

C. Structural Steel:

1. Steel posts to be hot rolled wide flange structural sections in accordance with shapes, sizes, details, and method of connection as shown on Drawings. All structural steel work to conform to ASTM A572 Grade 50 or ASTM A992 and bracing and anchor bolts to ASTM A36. All welds to conform to American Welding Society D1.1 and Electrodes to be E70XX. Structural steel components to be hot dipped galvanized after fabrication.
2. The structural steel to be installed plumb to within 1/16 of an inch. The posts to be located to the lines and grades specified on Drawings to within a tolerance of 1/16 of an inch.

2.3 MATERIALS

A. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.

B. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
3. For color-finished panels, use fasteners with heads that match color of panels.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Joint Sealants: As specified in Section 079200 "Joint Sealants."

2.4 FABRICATION

A. Factory assemble panels to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Where height of panels exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints.

C. All external panel connections, trim items, accessories, panel interfaces and other sections as noted on the Drawings will be sealed with an acoustical sealant that will not harden.

D. Include supports, anchorages, and accessories required for complete assembly.

2.5 GALVANIZED-STEEL SHEET FINISHES

A. Finish panels after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair in accordance with ASTM A780/A780M.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 2 mils.

1. Color: As selected by Architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Install panels according to manufacturer's instructions noting type, color, length, and recommendations, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

1. Field cutting of exterior panels should be approved by manufacturer.
2. Install panels with exposed fasteners pre-finished to match panel finishes.

B. Locate and place panels level, plumb, and at indicated alignment with adjacent work.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Provide components required for a complete acoustical barrier panel system, including trim, coping, supports and attachments, connections between panels, seam covers, sealants, fillers, closures strips and similar items.

3.4 CLEANING

A. See Section 017000-Execution and Closeout Requirements for additional requirements.

B. Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

C. Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

D. Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch up or similar minor repair procedures.

END OF SECTION

SECTION 092116

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acoustic insulation.

B. Cementitious backing board.

C. Gypsum wallboard.

D. Joint treatment and accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on gypsum board and accessories.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 BOARD MATERIALS

A. Manufacturers:

1. American Gypsum Company.
2. CertainTeed Corporation.
3. Georgia-Pacific Gypsum.
4. National Gypsum Company.
5. PABCO Gypsum.
6. USG Corporation.
7. Substitutions: See Section 016000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X or Type C board, UL or WH listed.
5. Thickness:
   a. Vertical Surfaces: 5/8 inch unless indicated otherwise.
   b. Ceilings: 1/2 inchunless indicated otherwise.

C. Backing Board For Wet Areas:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Thickness: 1/2 inchunless indicated otherwise.
   b. Manufacturers:
      1) Custom Building Products.
      2) National Gypsum Company.
      3) USG Corporation.
      4) Substitutions: See Section 016000 - Product Requirements.

2.3 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced .

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

1. Products:
   a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
   b. Liquid Nails, a brand of PPG Architectural Coatings; _____: www.liquidnails.com/#sle.
   c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.

C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.

1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
3. Manufacturers:

a. Phillips Manufacturing Co.
b. Stockton Products.
c. Trim-tex, Inc.
d. Substitutions: See Section 016000 - Product Requirements.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Paper Tape: 2 inch wide, creased paper tape for joints and corners.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.3 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.4 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

3.6 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.7 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 092216

NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings:

1. Indicate component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
2. Describe method for securing studs to tracks, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Metal Framing, Connectors, and Accessories:

1. ClarkDietrich.
2. MarinoWARE.
3. The Steel Network, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Loadbearing Studs: As specified in Section 054000.

C. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220.

1. Structural Grade: As required to meet design criteria.
2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.

D. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: C-shaped with flat faces.
2. Runners: U-shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

E. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short.

F. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

G. Non-Loadbearing Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
2. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
3. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.
4. Sheet Metal Backing: 0.0395 inch thick.
5. Fasteners: ASTM C1002 self-piercing self-tapping screws.
6. Anchorage Devices: Powder actuated.
7. Acoustic Insulation: See Section 092116.
8. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.3 FABRICATION

A. Fabricate assemblies to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C1007.

B. Extend partition framing to structure where indicated and to ceiling in other locations.

C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.

E. Align and secure top and bottom runners at 24 inches on center.

F. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
2. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.

G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

H. Install studs vertically at spacing indicated on drawings.

I. Align stud web openings horizontally.

J. Secure studs to tracks using crimping method. Do not weld.

K. Fabricate corners using a minimum of three studs.

L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

M. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.

N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

O. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

P. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

3.3 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inches on center, and not more than 6 inches from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

3.4 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 093000

TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Stone thresholds.

D. Non-ceramic trim.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

D. Samples for Verification: Provide two full size samples for each type of tile required, illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:

1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Tile: Three percent of each size, color, and surface finish combination installed.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.4 MOCK-UPS

A. See Section 014000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.

1. Minimum size of mock-up is indicated on drawings.
2. Approved mock-up may remain as part of work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.6 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 TILE

A. Basis of Design: Unless otherwise approved by the Architect; provide Products indicated in the Finish Schedule on the drawings or a comparable product by one of the following:

1. American Olean Corporation.
2. Dal-Tile Corporation.
3. Emser Tile, LLC.
4. Florim USA.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 TRIM AND ACCESSORIES

A. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.

1. Thickness: 5/8 inch.
2. Material: Marble, honed finish.
3. Color and Pattern: As selected by Architect.
4. Applications:
   a. At doorways where tile terminates.
   b. At open edges of floor tile where adjacent finish is a different height.

2.3 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

1. Applications: Use this type of bond coat at small tile installations.
2. Manufacturers:
   a. ARDEX Engineered Cements.
   b. Custom Building Products.
   c. H.B. Fuller Construction Products, Inc.
   d. LATICRETE International, Inc.
   e. Substitutions: See Section 016000 - Product Requirements.

C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
2. Manufacturers:
   a. ARDEX Engineered Cements.
   b. Custom Building Products.
   c. H.B. Fuller Construction Products, Inc.
   d. LATICRETE International, Inc.
   e. Substitutions: See Section 016000 - Product Requirements.

2.4 GROUTS

A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

1. Applications: Where indicated.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Manufacturers:
   a. ARDEX Engineered Cements.
   b. Custom Building Products.
   c. H.B. Fuller Construction Products, Inc.
   d. LATICRETE International, Inc.
   e. Substitutions: See Section 016000 - Product Requirements.

2.5 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type. See Section 079000 - Joint Sealants.

1. Applications: Between tile and plumbing fixtures.
2. Color: As selected by Architect from manufacturer's full line.

2.6 ACCESSORY MATERIALS

A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Crack Resistance: No failure at 1/8 inch gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
   a. Material: Liquid-latex rubber or elastomeric polymer.
   b. Thickness: 25 mils, minimum, dry film thickness.

c. Products:
   1) ARDEX Engineered Cements.
   2) Custom Building Products.
   3) H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
   4) LATICRETE International, Inc.
   5) Substitutions: See Section 016000 - Product Requirements.

B. Metal Edge Strips: Angle or L-shaped, height to match stone tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A666, 300 Series exposed-edge material.

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Schluter Systems L.P. or a comparable product by one of the following:
   a. Blanke Corporation.
   b. Ceramic Tool Company, Inc.

C. Metal Trim: Shaped metal trim pieces for outside corners, cove base and flooring transitions as described on drawings.

1. Basis-of-design Manufacturer: Schluter Systems.

D. Metal Base: Aluminum cove base as described on drawings.

1. Basis of Design Manufacturer and Style: Schluter Systems, Designbase-S.

E. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.3 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

END OF SECTION

SECTION 095100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Samples: Submit two full size samples illustrating material and finish of each type of acoustical unit required for project.

E. Samples: Submit two samples, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

1.4 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.5 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL UNITS

A. Acoustical Panels, Type A1: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Classification: ASTM E1264 Type IV.
2. Size: 24 by 24 inches.
3. Thickness: 3/4 inch.
4. Light Reflectance: 0.90 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.70, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
7. Panel Edge: Square.
8. Color: As selected by Architect.
9. Basis of Design Product:
   a. Armstrong World Industries, Inc; #1910 Ultima.
   b. Substitutions: See Section 016000 - Product Requirements.

B. Acoustical Panels, Type A2: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Classification: ASTM E1264 Type IV.
2. Size: 24 by 24 inches.
3. Thickness: 5/8 inch.
4. Light Reflectance: 0.89 percent, determined in accordance with ASTM E1264.
5. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
6. Panel Edge: Square.
7. Color: As selected by Architect.
8. Basis of Design Product:
   a. Armstrong World Industries, Inc.: #673 Kitchen Zone.
   b. Substitutions: See Section 016000 - Product Requirements.

2.3 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

C. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.

1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Color: As selected by Architect from manufacturers standard range.
5. Manufacturers:
   a. Armstrong World Industries, Inc.
   b. Certainteed Architectural.
   c. USG Corporation.
   d. Substitutions: See Section 016000 - Product Requirements.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Moldings: Same metal and finish as grid.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

F. Install hold-down clips on panels within 20 ft of an exterior door.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.6 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION

SECTION 096500

RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Resilient stair accessories.

D. Installation accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate floor patterns.

D. Verification Samples: Submit two full size samples, illustrating color and pattern for each resilient flooring product specified.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 100 square feet of each type and color.
3. Extra Wall Base: 100 linear feet of each type and color.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

1.5 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Vinyl Tile: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.

1. Basis of Design: Provide Timber Grove II Vinyl Tile as manufactured by Patcraft. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:
   a. Dal-Tile Corporation.
   b. Flexco Corporation.
   c. Gerflor USA, Inc.
   d. Karndean Designflooring.
   e. Mannington Commercial.
   f. TAJ Flooring.
   g. Urban Surfaces, Inc.
   h. Substitutions: See Section 016000 - Product Requirements.
2. Minimum Requirements: Comply with ASTM F1700, Class III.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
4. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329.
5. Plank Tile Size: 5.96 by 48 inch.
6. Total Thickness: 0.18 inch.
7. Color: To be selected by Architect from manufacturer's full range.

2.2 STAIR COVERING

A. Stair Treads: Rubber; full width and depth of stair tread in one piece; tapered thickness, with integral risers.

1. Basis of Design Manufacturer: Provide rubber stair treads manufactured by Tarkett USA. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:
   a. Flexco Corporation.
   b. Johnsonite, a Tarkett Company.

c. Mannington Commercial.
d. Roppe Corporation.
e. Substitutions: See Section 016000 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Nosing: Square.
5. Texture: Raised.
6. Pattern: Diamond.
7. Color: To be selected by Architect from manufacturer's full range.

2.3 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; Style A in carpeted areas, Style B in areas with resilient floor coverings.

1. Basis of Design Manufacturer: Provide wall base manufactured by Tarkett USA. Unless otherwise approved by the Architect; provide Products from manufacturer indicated or a comparable product by one of the following:
   a. Flexco Corporation.
   b. Johnsonite, a Tarkett Company.
   c. Mannington Commercial.
   d. Roppe Corporation.
   e. Substitutions: See Section 016000 - Product Requirements.
2. Height: 4 inches.
3. Thickness: 0.125 inch.
4. Finish: To be selected by Architect from manufacturer's full range.
5. Length: Roll.
6. Color: To be selected by Architect from manufacturer's full range.
7. Inside and Outside Corners: Job formed.

2.4 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material and manufacturer as flooring.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

E. Clean substrate.

F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.4 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.5 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

C. Scribe and fit to door frames and other interruptions.

3.6 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.7 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.8 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096566

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. Verification Samples: Actual flooring material specified, not less than 12 inch square .

E. Test Reports: Submit test reports showing compliance with ASTM F2772.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Manufacturer's Instructions: Indicate standard and special installation procedures.

H. Installer's qualification statement.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 10 square yards matching installed flooring.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

C. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

PART 2 PRODUCTS

2.1 PREFORMED ATHLETIC FLOORING

A. Rubber Sheet Flooring: Two-layer vulcanized rubber.

1. Thickness: Minimum 3/4 inch, nominal.
2. Sheet Width: Minimum 48 inches.
3. Durometer Hardness, Type A: Minimum of 75, when tested in accordance with ASTM D2240.
4. Surface Texture: Smooth.
5. Surface Pattern: Nondirectional.
6. Color: As indicated on drawings.
7. Basis of Design: Provide Achieve Rubber Flooring as manufactured by PLAE. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:
   a. Mondo America, Inc.
   b. North West Rubber.
   c. Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius.

C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Resilient Sheet Flooring:

1. Unroll flooring and allow to relax before beginning installation.
2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
5. Weld seams using techniques and equipment recommended by manufacturer.
6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

3.4 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.5 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 096813

TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two full size carpet tiles illustrating color and pattern design for each carpet color selected.

E. Accessory Samples: Submit two 12 inch long samples of edge strip.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.4 FIELD CONDITIONS

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Provide Kinitex, Network Modular Carpet Tile as manufactured by J&J Flooring. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:

1. Interface, Inc.
2. Mannington Commercial.
3. Milliken & Company.
4. Mohawk Group.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 MATERIALS

A. Tile Carpeting: Textile composite, manufactured in one color dye lot.

1. Tile Size: 24 by 24 inch, nominal.
2. Thickness: .205 inch.
3. Color: As selected by Architect from manufacturers standard range.
4. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
6. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity.
7. Pile Characteristic: Knitted pile.
8. Primary Backing Material: Polyester.
9. Total Weight: 4.5 - 5.2 oz/sq yd.

B. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturers standard treatment.
2. Antimicrobial Treatment: Manufacturers standard treatment as follows:
   a. Not less than 2 mm halo of inhibition for gram-positive bacteria, not less than 1 mm halo of inhibition for gram-negative bacteria, and no fungal growth, in accordance with AATCC 174.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Fully adhere carpet tile to substrate.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099123

INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and the application of paint systems on interior substrates.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
2. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project

1. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
2. Label each container with color in addition to the manufacturer's label

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.5 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Provide products as specified within paint Schedule in this Section or product by one of the following:

1. Benjamin Moore & Co.
2. PPG Paints.
3. The Sherwin Williams Co.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

B. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

C. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. Supply each paint material in quantity required to complete entire project's work from a single production run.

E. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

F. Flammability: Comply with applicable code for surface burning characteristics.

G. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

H. Colors: To be selected from manufacturer's full range of available colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
4. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Ferrous Metal:

1. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according toSSPC-SP 6Commercial Blast Cleaning. Protect from corrosion until coated.

H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

I. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 SURFACE PREPARATION OF PREVIOUSLY PAINTED SURFACES

A. Surfaces are to be clean and dry, free of dirt, dust, grease, and contaminants.

B. Existing painted surfaces: Remove loose and peeling paint. De-gloss surface if recommended by manufacturer. Sand smooth. Clean entire surface as recommended by the paint manufacturer prior to painting.

C. Gypsum Board Surfaces previously painted with epoxy paint: Dull existing epoxy surfaces by abrading and to the satisfaction of the Manufacturer. Wipe or vacuum surfaces clean of dust and foreign matter.

3.4 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply paints according to manufacturer's written instructions and to recommendations.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 FIELD QUALITY CONTROL

A. See Section 014000-Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas.

3.6 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.7 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.8 SCHEDULE - INTERIOR SURFACES - LATEX

A. Tints and colorants required should not add VOCs to the product.

B. Shop Primed Ferrous Metal: Semi-Gloss Finish:

1. Sherwin-Williams:
   a. Primer: Pro Industrial Pro-Cryl Universal primer.
   b. Finish: Two coats Pro Industrial High Performance Acrylic, semi-gloss.
2. PPG Paints:
   a. Primer: Pitt-Tech Plus Interior DTM Industrial Primer 4020.
   b. Finish: Two coats Pitt-Tech Plus EP Int/Ext DTM Industrial Enamel, semi-gloss 90-1610.

C. Ferrous Metal and Galvanized Metals: Semi-Gloss Finish:

1. Sherwin-Williams:
   a. Primer: Pro Industrial Pro-Cryl Universal primer.
   b. Finish: Two coats Pro Industrial High Performance Acrylic, semi-gloss.
2. PPG Paints:
   a. Primer: Pitt-Tech Plus Interior DTM Industrial Primer 4020.
   b. Finish: Two coats Pitt-Tech Plus EP Int/Ext DTM Industrial Enamel, semi-gloss 90-1610.

D. Interior Concrete Ceilings: Flat Finish:

1. Sherwin-Williams:
   a. Filler: One coat PrepRite Interior/Exterior Block Filler B25W25.
   b. Finish: Two coats ProMar 200 Zero VOC, flat.
2. PPG Paints:
   a. Primer: Perma-Crete Interior/Exterior Alkali Resistant Primer 6-403XI.
   b. Finish: Two coats Speedhide Zero VOC Latex semi-gloss,6-5110.

E. Concrete Masonry Units (CMU): Semi-Gloss Finish:

1. Sherwin-Williams:
   a. Filler: One coat PrepRite Interior/Exterior Block Filler B25W25.
   b. Finish: Two coats ProMar 200 Zero VOC, semi-gloss.
      1) Contains Anti-Microbial agents.
2. PPG Paints:
   a. Primer: Speed Hide Masonry Hi-Fill Latex block Filler 6-15XI.
   b. Finish: SpeedHide Zero VOC 6-5510, semi-gloss.

F. Concrete Masonry Units (CMU): Semi-Gloss Finish:

1. Sherwin-Williams:
   a. Microbicidal Paint – satin finish:
      1) Primer: Loxon Block Surfacer
      2) 2 finish coats: SuperPaint with Sanitizing Technology, Interior Latex Satin Microbicidal paint (no substitutions).
2. PPG Paints:
   a. PPG Pure Performance Primer

b. PPG Copper Armor – Anti VIRAL & Anti Bacterial (No Substitutions).
1) EPA Registration 56601-4.

G. Concrete Masonry Units (CMU): Semi-Gloss Finish:

1. Sherwin-Williams:
a. Odor eliminating, Air purifying technology paint – satin finish.
1) Primer: ProMar 200 Latex Primer.
2) 2 finish coats: SuperPaint Air Purifying Technology Acrylic, satin.
2. PPG Paints:
a. Primer: PPG Speedhide Latex Primer Zero VOC 6-4900XI.
b. PPG Pure Performance, NO VOC, Eggshell, 9-300XI.

H. Concrete Masonry Units: Epoxy Egg Shell Finish:

1. Sherwin-Williams:
a. Filler: ProIndustrial Heavy Duty Block Filler, B42W46,
b. Finish: Two coats Pro Industrial Pre-Catalyzed Water Based Epoxy Eg-Shel, K45 Series, <150 g/L VOC, each coat.
2. PPG Paints:
a. Primer: Speed Hide Masonry Hi-Fill Latex block Filler 6-15XI.
b. Finish: Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Water-Borne Epoxy Eggshell 16-310 Series <100 g/L VOC, each coat.

I. Exposed Metal Deck & Joists: Flat Acrylic:

1. Sherwin-Williams:
a. Factory Primed -Spot Prime bare metal areas. Bare Metal – Full prime coat: ProIndustrial Pro-Cryl Universal Primer.
b. Finish: Two coats Waterborne Acrylic Dry Fall B42W1.
2. PPG Paints
a. Finish: PPG Paints Speedhide Super Tech Flat Acyrlic DryFall 6-725XI
1) No Primer Required: - PPG Dryfall is Self-Priming.

J. Gypsum Board: Flat Finish:

1. Sherwin-Williams:
a. Primer: One coat. ProMar 200 Zero VOC Primer.
b. Finish: Two coats. ProMar 200 Zero VOC Flat.
1) Contains Anti-Microbial agents.
2. PPG Paints:
a. Primer: PPG Speedhide zero Interior Zero-VOC Latex Sealer 6-4900XI..
b. Finish: Two coats Speedhide Zero VOC, Flat 6-5110.

K. Gypsum Board: Eggshell Finish:

1. Sherwin-Williams:
a. Primer: One coat ProMar 200 Zero VOC Primer.
b. Finish: Two coats ProMar 200 Zero VOC Eg-Shel.
1) Contains Anti-Microbial agents.
2. PPG Paints:
a. Primer: PPG Speedhide zero Interior Zero-VOC Latex Sealer 6-4900XI..
b. Finish: Two coats Speedhide Zero VOC, Eggshell 6-5310.

L. Gypsum Board: Eggshell Finish:

1. Sherwin-Williams:
   a. Microbicidal Paint – satin finish:
      1) Primer: ProMar 200 Latex Primer.
      2) 2 finish coats: SuperPaint with Sanitizing Technology, Interior Latex Satin Microbicidal paint (no substitutions).
2. PPG Paints:
   a. PPG Pure Performance Primer
   b. PPG Copper Armor – Anti VIRAL & Anti Bacterial (No Substitutions).
      1) EPA Registration 56601-4.

M. Gypsum Board: Eggshell Finish:

1. Sherwin-Williams:
   a. Odor eliminating, Air purifying technology paint – satin finish.
      1) Primer: ProMar 200 Latex Primer.
      2) 2 finish coats: SuperPaint Air Purifying Technology Acrylic, satin. (no substitutions).
2. PPG Paints:
   a. Primer: PPG Speedhide Latex Primer Zero VOC 6-4900XI.
   b. PPG Pure Performance NO VOC, Eggshell, 9-300XI.

N. Gypsum Board: Semi-Gloss Finish:

1. Sherwin-Williams:
   a. Primer: One coat ProMar 200 Zero VOC Primer.
   b. Finish: Two coats ProMar 200 Zero VOC semi-gloss.
      1) Contains Anti-Microbial.
2. PPG Paints:
   a. Primer: PPG Speedhide zero Interior Zero-VOC Latex Sealer 6-4900XI..
   b. Finish: Two coats Speedhide Zero VOC, semi-gloss 6-5510XI.

O. Gypsum Board – Dry areas Semi-Gloss Epoxy:

1. Sherwin-Williams:
   a. Primer: Promar 200 Zero VOC primer.
   b. Finish: Two coats Pro Industrial Pre-Catalyzed Water Based Epoxy, semi-gloss K46 Series,
2. PPG Paints:
   a. Primer: Speedhide ZERO Interior Zero-VOC Latex Sealer 6-4900XI.
   b. Finish: Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Water-Borne Epoxy Semi-gloss 16-510Series <100 g/L VOC, each coat.

P. Wood: Semi-Gloss Finish – 100% acrylic:

1. Sherwin-Williams:
   a. Primer: Not required.
   b. Finish: Two coats Solo 100% Acrylic, semi-gloss.
2. PPG Paints:
   a. Primer: Not required.
   b. Two Coats Break Through! V62-510 series (2 coats).

c. Sand unpainted wood or wood in poor condition smooth, wiped clean, then primed. Any knots or resinous areas must be primed before painting. For non-bleeding or previously painted wood, no primer is required.

Q. Previously Painted Substrates:

1. Sherwin-Williams:
   a. Primer: Extreme Bond Primer.
   b. Finish: TBD.
2. PPG Paints:
   a. Primer: PPG Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer 17-921XI.
   b. Finish: TBD.

3.9 SCHEDULE - INTERIOR SURFACES – HIGH PERFORMANCE WATER BASED EPOXY

A. Factory Primed Metals: Semi-Gloss/Gloss Finish:

1. Sherwin-Williams: ProIndustrial WaterBased Catalyzed Epoxy
   a. Primer: Pro Industrial Pro-Cryl Universal Primer.
   b. Finish: Two coats Pro Industrial Water Based Catalyzed Epoxy, gloss B73-300 Series.
2. PPG Paints:
   a. Primer: PPG Pitt Tech Plus 4020PF.
   b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

B. Gypsum Board: Semi-Gloss/Gloss Finish:

1. Sherwin-Williams:
   a. Primer: One Coat ProMar 200 Zero VOC Primer, B28W02600.
   b. Finish: Two coats Pro Industrial Water Based Catalyzed Epoxy, gloss B73-300 Series.
2. PPG Paints:
   a. Primer: PPG Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer 17-921XI.
   b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

C. Concrete Masonry Units: Egg Shell Finish:

1. Sherwin-Williams:
   a. Filler: Heavy Duty Block Filler, B42W46, <100 g/L VOC.
   b. Finish: Two coats Pro Industrial Pre-Catalyzed Water Based Epoxy Eg-Shel, K45 Series.
2. PPG Paints:
   a. Primer: PPG Speedhide Hi-Fill Block Filler 6-15XI.
   b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

3.10 SCHEDULE - INTERIOR SURFACES - HIGH PERFORMANCE (WATER BASED EPOXY)

A. Ferrous Metals (Doors, Frames, Miscellaneous Metals including Handrails, and Columns): Egg Shell Finish — Low Odor Zero VOC Topcoat:

1. Sherwin-Williams:

a. Primer: One coat: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, <100 g/L VOC.
b. Finish: Two coats Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series.

2. PPG Paints:
a. Primer: PPG Pitt Tech Plus 4020PF.
b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

B. Non-Ferrous Metals (Doors, Frames, Handrails, including overhead galvanized decking): Egg Shell Finish — Low Odor Zero VOC Topcoat:

1. Sherwin-Williams:
a. Primer: One coat: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
b. Finish: Two coats Pro Industrial Water Based Catalyzed Epoxy Eg-Shel, B73-360 Series.

2. PPG Paints:
a. Primer: PPG Pitt Tech Plus 4020PF.
b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

C. Concrete Masonry Units (Wet Areas, Pool Area, Showers): Semi-Gloss:

1. Sherwin-Williams:
a. Filler: One coat Kem Cati-Coat HS Epoxy Filler/Sealer, Part A B42W400, Part B B42V401, at 14.0 – 28.0 mils wet, 10.0 – 20.0 mils dry.
b. Finish: Two coats Macropoxy 646-100 Fast Cure Epoxy, B58-620.

2. PPG Paints:
a. Primer: PPG Cementitious Waterproofing Block Filler 95-217.
b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

D. Concrete Masonry Units (Dry Areas, Restrooms, Offices, Locker Rooms, Closets and Stairwells): Egg Shell Finish:

1. Sherwin-Williams:
a. Filler: ProIndustrial Heavy Duty Block Filler, B42W46, <100 g/L VOC.
b. Finish: Two coats Pro Industrial Pre-Catalyzed Water Based Epoxy Eg-Shel, K45 Series.

2. PPG Paints:
a. Primer: PPG Speedhide Hi-Fill Block Filler 6-15XI.
b. Finish: PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Water-Borne Epoxy Eggshell 16-310Series <100 g/L VOC, each coat.

E. Gypsum Board – Wet Areas Semi-Gloss:

1. Sherwin-Williams:
a. Primer: Promar 200 Zero VOC primer.
b. Finish: Two coats Pro Industrial Water Based Catalyzed Epoxy, gloss B73-300 Series, (no pre-catalyzed coatings).

2. PPG Paints:
a. Primer: PPG Speedhide ZERO Interior Zero-VOC Latex Sealer 6-4900XI.
b. Finish: PPG Aquapon WB EP Epoxy 98E Series Semi-Gloss/ Gloss available.

F. Gypsum Board – Dry areas Semi-Gloss:

1. Sherwin-Williams:
   a. Primer: Promar 200 Zero VOC primer.
   b. Finish: Two coats Pro Industrial Pre-Catalyzed Water Based Epoxy, semi-gloss K46 Series.
2. PPG Paints:
   a. Primer: PPG Speedhide Primer 6-4900XI.
   b. Finish: PPG Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Water-Borne Epoxy Eggshell 16-310Series <100 g/L VOC, each coat.

END OF SECTION

SECTION 099999

INTERIOR FINISHES PRODUCT SUMMARY (BASIS OF DESIGN)

1. Acoustical Panel Ceiling (APC) with Grid Type and Ceiling Accent Trim (CA). Refer to Reflected Ceiling Plans and Finish Schedule for locations. Note: all ceiling grids to be white unless otherwise noted.

    a. APC1: Armstrong World Industries Inc., Ultima Lay In, 24x48x3/4" color: white, Square Edge with 15/16 Exposed Grid color white.

2. Anti Skid floor coating (AS)

    a. AS1: Sherwin Wiliams ResuGrip 150, color: TBD (Dugout steps and where noted in plans).

3. Paint (PT): Refer to Finish Plan for locations.

    a. PT1: Sherwin Williams Promar 200, color: # SW7667 Zircon – (general wall paint).

    b. PT2: Sherwin Williams Promar 200, color: # SW6070 Heron Plume – (wall paint at showers, grooming, restrooms, hydro, laundry).

    c. PT3: Sherwin Williams Promar 200, color: # SW7066 Gray Matters – (door frames in PT1 walls).

    d. PT4: Sherwin Williams Promar 200, color: # SW9163 Tin Lizzie – (door frames in PT2 walls).

    e. PT5: Sherwin Williams Promar 200, color: # SW6886 Invigorate [FLAT] – Accent Walls.

    f. PT6: Sherwin Williams Promar 200, color: # SW7006 Extra White – (Batting Arena ceiling).

    g. PT7: Sherwin Williams Promar 200, color: to match new batters eye – (Batting Arena walls).

    Typical Paint Finish: Flat (drywall ceilings, Unless Otherwise Noted).
    Typical Paint Finish: Eggshell (wall paint, Unless Otherwise Noted).
    Typical Paint Finish: Semi-gloss Acrylic Alkyd SG B34-8200 (metal doors and trim, Unless Otherwise Noted).

4. Wall Base (WB)

    a. WB1: Tarkett Baseworks thermoset rubber base, 4" with toe, color – 63 Burnt Umber.

    b. WB2: Porcelain wall base, 4", MFC and color TBD (all porcelain tile floor areas that do not have tiled walls).

5. Carpet (CPT): Refer to Floor Finish Plans and Finish Schedule for locations. All carpet types are to be cleat resistant products.

    a. CPT1: J&J Invision, Pattern: Adjust 7601, color: 3268 Cool Oasis, size: 18x36, (Training rooms, main hallways).

    b. CPT2: J&J Invision, Pattern: Cardigan 7591, color: 3333 Knit Stitch, size: 18x36, (Managers and coaches locker rooms, office spaces).

    c. CPT3: Interface, Pattern: Play the Angle, color: 107189 Phosphorus, size: 25 cm x 1 m, (Home and Visitor Locker Rooms).

    d. CPT4: Interface, Pattern: Play the Angle, color: 107191 Carbon, size: 25 cm x 1 m, (Home Locker Room accent).

6. Luxury Vinyl Tile (LVT)

    a. LVT1: Armstrong, Pattern: Natural Creations NA190, Color: Moroccan Sand, size: 6”x36”, (Training room at counter, Multi-purpose Doctors Office, Dining rooms)

7. Porcelain Tile (PCT)

    a. PCT1: Conestoga, Pattern: Florida Tile, Aura, color Antracita Charcoal, size: 12”x24” (Grooming areas, Restrooms, Toilet Rooms).

    b. PCT2: Conestoga, Pattern: Florida Tile, Aura, color Antracita Charcoal, size: 2”x2” mosaic (Shower rooms, Hydro rooms).

    c. PCT3: Architessa, Pattern: Nottingham Oak, matte, size: 8”x40” (accent wall in Hydro rooms, Wet walls in Restrooms and Toilet Rooms)

    d. PCT4: American Olean, Pattern: Colorstory, gloss, color: Ice White 0025, size: 8”x24” (Shower Rooms).

    e. PCT4: American Olean, Pattern: Colorstory, gloss, color: TBD, size: 8”x24” (Shower Room accent tile).

8. Rubber Athletic Flooring (RAF)

    a. RAF1: Plae, Aspire, color: Orange Gray 306, size: 24”x24”x1” (Shared Weight Room).

9. Synthetic Turf Flooring (SYT)

    a. SYT1: Plae, Attack, color: green, set on ¾” rubber sub-pad (Batting Arena, Shared Weight Room strip).

10. Sealed Concrete (SC)
    a. SC: Sherwin Williams epoxt water emulsion primer/sealer, GP3477

SECTION 101423

PANEL SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Panel signage.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   c. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

E. Verification Samples: Submit samples showing colors, materials, and finishes specified.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

G. Manufacturer's qualification statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store under cover and elevated above grade.

D. Store tape adhesive at normal room temperature.

1.5 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Panel Signage:

1. Best Sign Systems, Inc.
2. Inpro Corporation.
3. Mohawk Sign Systems, Inc.
4. Vista System LLC.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 PANEL SIGNAGE

A. Panel Signage::

1. Application: Interior directional and information signs.

16. Profile: Curved one-piece extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
    a. Frame Finish: Natural clear anodized.
    b. Sign Orientation: Curved in horizontal section.
17. Tactile Letters: Raised 1/32 inch minimum.
18. Braille: Grade II, ADA-compliant.
19. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.
20. One-Sided Wall Mounting: Concealed or exposed screws.

2.4 SIGNAGE APPLICATIONS

A. Refer to the drawings for signage schedule and locations.

2.5 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Exposed Screws: Chrome plated.

C. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION

SECTION 102113.19

PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 12 by 12 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Solid Plastic Toilet Compartments:

1. All American Metal Corp - AAMCO.
2. AJW Architectural Products.
3. ASI Accurate Partitions.
4. ASI Global Partitions.
5. Hadrian.
6. Inpro.
7. Metpar Corp.
8. Partition Systems International of South Carolina.
9. Scranton Products.
10. Substitutions: Section 016000 - Product Requirements.

2.2 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.

B. Provide manufacturer's no-sightline system, between doors, panels and pilasters.

1. Doors:
   a. Thickness: 1 inch.
   b. Width: 24 inch.
   c. Width for Handicapped Use: 36 inch, out-swinging.
   d. Height: 55 inch.
2. Panels:
   a. Thickness: 1 inch.
   b. Height: 55 inch.
3. Pilasters:
   a. Thickness: 1 inch.
   b. Width: As required to fit space; minimum 3 inch.

2.3 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Extruded aluminum, anti-grip profile.

1. Size: Manufacturer's standard size.

C. Wall Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hinges: Stainless steel, manufacturer's standard finish.

1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

F. Door Hardware: Stainless steel, manufacturer's standard finish.

1. Door Latch: Slide type with exterior emergency access feature.
2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
3. Provide door pull for outswinging doors.

G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Crash rails.

B. Corner guards and end-wall guards.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards and bumper rails, 24 inches long.
2. Submit two samples of protective wall covering, 6 by 6 inches square.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Stock Materials: One package(s) of minimum 96 inches long unit of each kind of covers for corner guards and bumper rails.
3. Extra Stock Materials: 100 square feet of each kind of protective wall covering and door surface protection.

G. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Crash Rails and Corner Guards:

1. Babcock-Davis.
2. Construction Specialties, Inc.
3. Inpro.
4. Koroseal Interior Products.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

2.3 PRODUCT TYPES

A. Crash Rails: Factory- or shop-fabricated, with preformed end wall returns, and internal and external corners:

1. Performance of Installed Assembly:
   a. Support vertical live load of 100 lb/lineal ft with deflection not to exceed 1/50 of span between supports.
   b. Resist lateral force of 250 lbs at any point without damage or permanent set.
2. Retainer Material: Metal; 6061-T6511 Aluminum.
3. Cover: Continuous snap on plastic.
   a. Colver Color: As selected by Architect from manufacturers standard range.
4. Configuration: Nominal 4 inches high by 1 inch deep.
5. Mounting: Surface.
6. Finishes.
   a. Aluminum, MIL-A-8625, Type II, Clear.

B. Corner Guards and End-Wall Guards - Surface Mounted:

1. Material: Type 304 stainless steel, No. 4 finish, 0.0625 inch thick.
2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
3. Width of Wings: 3-1/2 inches.
4. Corner: Radiused.
5. Length: One piece.

2.4 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that concealed blocking and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

D. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guards and crash rails at heights indicated on drawings.

C. Terminate rails 1 inch short of door openings and intersecting walls.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial shower and bath accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Samples: Submit two samples of each accessory, illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers and Products: Basis of Design as indicated in on the Drawings, or a comparable product by one of the following and approved by the Architect.

1. AJW Architectural Products.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc
4. Bradley Corporation.
5. Brocar Products, Inc
6. Substitutions: Section 016000 - Product Requirements.

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide 5 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Zinc Alloy: Die cast, ASTM B86.

G. Acrylic Plastic Sheet: ASTM D4802.

H. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

I. Adhesive: Two component epoxy type, waterproof.

J. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.3 FINISHES

A. As indicated in schedule on the drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. Verify installation of blocking, reinforcing plates, and concealed anchors in walls.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 104400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:

1. Activar Construction Products Group, Inc. - JL Industries.
2. Kidde, a unit of United Technologies Corp.
3. Nystrom, Inc.
4. Oval Brand Fire Products.
5. Potter-Roemer.
6. Substitutions: See Section 016000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:

1. Activar Construction Products Group, Inc. - JL Industries.
2. Kidde, a unit of United Technologies Corp.
3. Nystrom, Inc.
4. Oval Brand Fire Products.
5. Potter-Roemer.
6. Substitutions: See Section 016000 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Stored Pressure Operated: Deep Drawn.
2. Class: A:B:C type.
3. Size: 10 pound.
4. Finish: Baked polyester powder coat, color as selected.

2.3 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.

1. Formed primed steel sheet; 0.036 inch thick base metal.

C. Fire Rated Cabinet Construction: One-hour fire rated.

1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.

D. Cabinet Configuration: Recessed type.

1. Size to accommodate accessories.
2. Trim: Flat square edge.

E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

F. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

J. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, at height in accordance with AHJ.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 105613

METAL STORAGE SHELVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Four post shelving.

B. Shelving accessories.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Rated uniform shelf loads.
2. Details of shelving assemblies, including reinforcement.
3. Accessories.
4. Substrate preparation instructions and recommendations.
5. Storage and handling requirements and recommendations.
6. Installation methods.
7. Specimen warranty.
8. Maintenance methods.

C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.

1. In lieu of test reports, detailed drawings stamped and sealed by a Professional Engineer licensed in the State in which the Project is located will be acceptable.

D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.

1. Indicate methods of achieving specified anchoring requirements.

E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Extra Shelves: Two of each size with shelf brackets.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of documented experience and approved by manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.

B. Store in manufacturer's unopened packaging until ready for installation.

C. Store under cover and elevated above grade.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Four Post Shelving:

1. ASI Storage Solutions.
2. Hallowell.
3. Penco Products, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 SHELVING - GENERAL

A. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.

1. Provide hardware of type recommended by manufacturer for substrate.
2. See drawings for additional details of anchorage.

2.3 FOUR POST SHELVING

A. Four Post Shelving: Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.

1. Unit Width: 36 inches, center to center of posts.
2. Shelf Capacity: Uniform distributed load of 50 psf, minimum.
3. Shelf Beam Capacity: 1200 lbs per shelving bay.
4. Shelf Deflection: L/140, maximum, under specified uniform load.
5. Adjustability of Shelving: Continuous along length of post.
6. Unit Depth: Not more than 1/4 inch greater than shelf depth.

7. Shelves per Unit: As indicated on drawings.
8. Unit Height: 72 inches, overall , maximum.
9. Finish: Baked enamel, medium gloss.
10. Color: As selected by Architect from manufacturer's standard range.
11. Number of Units: As indicated on drawings.

B. Posts and Beams: Formed sheet members; perforations exposed on face of members are not acceptable.

1. Metal Thickness: 16 gauge, 0.0598 inch.
2. Post Shape: Tee intermediate posts, angle end posts forming corners.
3. Post Face Width: 2 inches, maximum.
4. Connecting Hardware: Manufacturer's standard.
5. Post Bases: Flat steel foot plate , with manufacturer's recommended adjustable leveling device.

C. Bracing: Formed sheet members.

1. Back Sway Bracing: Either strap or panel; at back of each unit.
2. Side Sway Bracing: Either strap or panel; at each side of each unit.
3. Strap Sway Bracing: One strap installed diagonally, 16 gauge, 0.0598 inch; welded, riveted, or bolted to uprights.
4. Panel Sway Bracing: Formed sheet metal panels, 20 gauge, 0.0359 inch; welded, riveted, or bolted to uprights.
5. See drawings for additional details of bracing.

D. Shelves: Formed sheet, finished on all surfaces , with slots for dividers.

1. Metal Thickness: 18 gauge.
2. Shelf Edge Profile: Extending 3/4 inch, maximum, below top surface of shelf.
3. Shelf Connection to Posts: Manufacturer's standard.

2.4 ACCESSORIES

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.

B. Verify that walls are suitable for shelving attachment.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.

C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.4 CLEANING

A. Clean shelving and surrounding area after installation.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 107316.13

METAL CANOPIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Attached metal canopies.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.

D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Erector's Qualification Statement.

H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1. Comply with applicable code for submission of design calculations as required for acquiring permits.
2. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.

1. Not less than three years of documented experience.

C. Erector Qualifications: Company specializing in performing the work of this section.

1. Not less than three years of documented experience and approved by canopy manufacturer.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials to project site ready for erection.

C. Package using methods that prevent damage during shipping and storage on site.

D. Store materials under cover and elevated above grade.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's 20 year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design – Super Lumideck Cantilever Canopy with Flat Soffit as manufactured by Mapes Canopies. Unless otherwise approved by the Architect; provide Product indicated or a comparable product by one of the following:

1. Sportsfield Specialties
2. Mitchell Metals, LLC.
3. Queen City Awning.
4. MASA Architectural Canopies.
5. Substitutions: See Section 016000 - Product Requirements.

2.2 METAL CANOPIES

A. Configuration: Layout and dimensions, column layout, canopy clearance, fascia profile, and roof covering design as indicated on drawings.

1. Installation: Cantilever-mounted to building structure with tension members.
2. Structural Framing System: Aluminum.
3. Covering Material: Aluminum.

4. Drainage Concept: Water collected in decking conducted into perimeter gutters and discharged through downspouts.

B. Performance Requirements:

1. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
   a. Loads: As indicated on drawings.
2. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

2.3 COMPONENTS

A. Structural Aluminum Framing: Alloy and temper 6063-T5, 6063-T6, or 6061-T6.

1. Extruded Shapes and Tubes: ASTM B221 (ASTM B221M).
2. Rolled or Extruded Structural Shapes: ASTM B308/B308M.
3. Extruded Structural Pipe and Tube: ASTM B429/B429M.
4. Sheet and Plate: Alloy 5052, 5005, or 6061-T651, ASTM B209/B209M.

B. Covering:

1. Aluminum Decking:
   a. Interlocking extruded aluminum decking modules.
      1) Extruded Decking: ASTM B221 (ASTM B221M), Alloy and temper 6005-T5, 6061-T6, or 6063-T6.
   b. Decking Orientation: As indicated on drawings.
2. Overhang: As indicated on drawings.

C. Fascia: Manufacturer's standard aluminum "J" style profile.

D. Anchor Bolts: ASTM A307 or ASTM A572/A572M, formed with bent shank, assembled with template for casting into concrete.

1. Minimum exposed thread of 7 inches above footing and 23 inch minimum embedment.
2. Provide nuts and washers as required for column leveling and plumbing.

E. Concrete Footings: Refer to Section 033000 for additional requirements.

F. Gutters and Downspouts: Refer to Section 077123 for additional requirement, color to match canopy covering, manufacturer's recommended size for canopy specified.

2.4 SHOP FABRICATION

A. Provide a complete system ready for erection at project site.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. Weld steel members in accordance with AWS D1.1/D1.1M.

D. Weld aluminum members in accordance with AWS D1.2/D1.2M.

E. Fabricate connections for bolt, nut, and washer connectors.

2.5 FINISHES

A. Aluminum Framing and Decking:

1. Superior Performing Organic Coatings: AAMA 2605, multiple coats, thermally cured, polyvinylidene fluoride system.
2. Color: As indicated on the drawings.

B. Fascia: Fluoropolymer finish color to match surrounding assembly unless indicated otherwise.

2.6 ACCESSORIES

A. Structural Bolts: ASTM F3125/F3125M, Grade A325, minimum 3/4 inch diameter.

B. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.

1. Exposed Fasteners: Not permitted.

C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Verify that bearing surfaces are ready to receive this work.

D. Do not proceed with installation until all conditions are satisfactory.

3.2 INSTALLATION - FRAMING

A. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.

B. Set column base plates with non-shrink grout to achieve full plate bearing.

C. Fasten columns to anchor bolts.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.3 INSTALLATION - CANOPY COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to metal support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.4 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.5 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.6 PROTECTION

A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 113013

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

C. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

A. Manufacturers: Refer to Appliance Schedule on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions

C. Anchor built-in equipment in place.

3.3 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.4 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 115213

PROJECTION SCREENS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Front projection screen assemblies; electrically operated, concealed in ceiling.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Wiring diagrams for motor operators and actuators, and controls and switches.

C. Shop Drawings: For custom installations, indicate dimensions, verified field measurements, mounting details, and interface with adjacent construction.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.

B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.

C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5 year manufacturer warranty for projection screen assembly.

PART 2 PRODUCTS

2.1 FRONT PROJECTION SCREENS

A. Manufacturers: Provide Products by one of the Manufacturers indicated below, unless otherwise approved by the Architect:

1. Bretford
2. Da-Lite Screen Company
3. Draper, Inc (Motorized)
4. Stewart Filmscreen Corporation
5. Substitutions: See Section 016000 - Product Requirements.

B. Front Projection Screens: Factory assembled unless otherwise indicated.

1. Dimensions: As selected by Architect
2. Located in Amenity Space Movie Room: Motorized, matte light diffusing fabric screen, horizontally tensioned, wall mounted.

C. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.

1. Material: Matte white vinyl on fiberglass backing, with nominal gain of 1.0 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
2. Seams: No seams permitted in fabric up to 96 inch high by 72 inch wide.

D. Concealed-in-Ceiling Screen Cases: Steel, with integral roller brackets.

1. Door Slat: Self trim; self-closing and -opening.
2. Case Finish: Baked enamel.
3. Case Color: As selected by Architect..
4. End Caps: Steel; finished to match case.
5. Electrically-Operated Screens: 1-1/2 inch aluminum door roller.

E. Electrically-Operated Screens:

1. Roller: Steel, with locking device. Manufacturer's standard size.
2. Vertical Tensioning: Screen fabric weighted at bottom with steel bar and plastic end caps.
3. Horizontal Tensioning: Tab-guided cable system.

F. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.2 ELECTRICAL COMPONENTS

A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.

B. Motors: Manufacturer's standard. Refer to drawings for available power.

C. Controls: Three (3) position control switch with plate.

1. Provide two control stations to screen, with internal override to prevent more than one signal reaching the screen.
2. Security: Provide key-locking cover plate; provide 2 keys.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Verify type and location of electrical connections.

E. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.2 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Install electrically operated screens ready for connection to power and control systems by others.

F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

G. Test electrical screens for proper working condition. Adjust as needed.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 116833

ATHLETIC FIELD EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Baseball batting cages.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meetings: Convene a meeting one week before starting this work to discuss coordination between various installers.

1. Require attendance by personnel responsible for grading and installers of athletic field equipment, footings, and adjacent work.
2. Include representatives of Contractor.

1.3 SUBMITTALS

A. Product Data: Provide athletic field equipment manufacturer's product data indicating materials of construction, compliance with specified standards, installation procedures, and necessary safety limitations.

B. Shop Drawings: Submit detailed scale drawings showing athletic field equipment and perimeter layout.

C. Manufacturer's Qualification Statement.

D. Installer's Qualification Statement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store equipment on project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, and elevated above grade.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum 3 year manufacturer warranty for athletic field equipment.

PART 2 PRODUCTS

2.1 ATHLETIC FIELD EQUIPMENT - GENERAL

A. Mount supporting posts in concrete footings, unless otherwise indicated, refer to Section 033000 for additional concrete footing installation requirements.

1. Provide supports as required to mount equipment at proper height above finished grade.

B. Safety and Warning Signage: Provide signage as indicated on drawings and required by authorities having jurisdiction.

2.2 INDOOR MOTORIZED VERTICALLY RETRACABLE BASEBALL BATTING CAGE

A. Manufacturers:

1. Grand Slam Safety, LLC.
2. Turbolink International.
3. Sportsfield Specialties, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

B. Baseball Cage: Overhead superstructure with netting supported by 4 inch diameter extruded aluminum poles equipped with rope and pulley system to raise and lower net at post locations.

1. Size of Cage: refer to plans.
2. Support structure: Includes Building Connections, Overhead Supports and Net Support HSS 3.500” O.D. x 0.216” & HSS 4.000” O.D. X 0.226” Wall Steel Drive Pipe Assembly with powder coated finish.
3. Motorized Lift Winch, ¾ Horsepower (Electric): 110/115 V Single Phase, Voltage: 120 AC, Current: 11.5 FLA, Frequency: 60 HZ. 1,000 lbs. Vertical Lift Capacity. 9.5 ft/min Pull Speed with Instant Reversing. Includes 5’ Power Cord with Twist Lock Plug, Toggle Key Switch and Electrical Box, Note: Electrical by Others
4. Netting Drive Line
   a. 1-1/2” Sch 40 Alum Pipe
   b. BTR Spool & BTR Roller Bracket Assembly
      - Steel
   c. Strut Channel and Structure Mount
      - Steel and 7 Guage (.180”) HR P&O Steel Sheet
   d. Bolted Connections
   e. Powder Coated Black
5. Fixed and Movable Net Support
   a. 2” Square, .125” Wall Aluminum Tube
   b. Protected Hardware with Shrink Tubing
   c. Encased Vinyl Pockets
6. Cable
   a. 1/8” Galvanized Aircraft Cable (GAC)
7. Sewn in vinyl cable locations passing through D-Ring type cable guides
8. Divider Net
   a. #36 Black Nylon Net, 1-3/4” Square Mesh with Rope Bound Perimeter
   b. #36 Twisted Knotted Netting
   c. 100% Nylon Construction
   d. 2.6 mm (0.1023”) Diameter Twine
   e. 87% Open Mesh Area (See-Through Visibility)
   f. 13,363 psi Minimum Breaking Strength
   g. 1-3/4” (44mm) Maximum Square Mesh Size

h. 0.0425 lbs. per Square Foot.
i. Black Multi-Filament Polypropylene Solid Braid Derby Rope Sewn Binding on Perimeter Edges – ¼" Diameter, 530 lb. Minimum Breaking Strength

9. Provide hardware and accessories as required for complete assembly.

2.3 MATERIALS

A. Netting Cabling, Track, and Connections:

1. Cable: Prestretched zinc coated structural steel wire rope complying with ASTM A603.
   a. Modulus of Elasticity: 20,000 ksi minimum.
2. Fittings, Pulleys, Hangers, etc.: Steel castings, galvanized in accordance with ASTM A148.
3. Miscellaneous connection plates: ASTM A36 steel, galvanized in accordance with ASTM A153.
4. Track: ASTM A36 steel, primed for painting in field. Arrangement as shown in drawings. Two tracks maximum per batting cage.

B. Netting: Provide 1 ¾" x 1 ¾" mesh netting that complies with the following:

1. Yarn Type: Heavy Duty UV treated black knotted nylon.
2. Weight: #42 gauge nylon.
3. Cord: Provide net manufacturer's standard cord or ties for lacing netting to supports.
4. Custom Sewn doors and vinyl backdrops for hanging behind batters.

C. Hardware: Provide design without hazardous protrusions, corners, or finishes, and requiring tools for removal after installation; countersunk fasteners are preferred.

1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
2. Use stainless steel for wood-to-wood and wood-to-metal connections.
3. Use stainless steel with plastic components.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that athletic field equipment area has been graded to subgrade elevations required and that excess soil, rocks, and debris has been removed as necessary for installation of footings.

3.2 PREPARATION

A. Stake location of athletic field equipment elements, including necessary athletic field perimeters, surfacing, access and egress points, hard surfaces, walls, fences, and/or structures.

B. Stake layout of athletic field equipment perimeter in accordance with approved shop drawings before starting any work.

1. Verify that athletic field perimeters do not overlap hard surfaces, whether currently installed or not.
2. Verify that athletic fields are free of obstructions.
3. If conflicts or obstructions are found, notify Architect.
4. Do not proceed with this work until revised drawings have been provided, showing corrected layout, and that any obstructions have been removed or corrections to layout have been made.

3.3 INSTALLATION

A. Install athletic field equipment in accordance with manufacturer's instructions, and rules and regulations of specified athletic association indicated for this work.

B. Install athletic field equipment without sharp points, edges, or protrusions; entanglement hazards or pinch, crush, or shear points.

C. Install safety and warning signage, as follows, in accordance with indicated requirements.

3.4 CLEANING

A. Clean athletic field equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation; clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

B. Clean athletic field area of excess construction materials, debris, and waste.

C. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

3.5 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 68 33.33

BASEBALL FIELD EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all equipment and materials, and do all work necessary to furnish and install the athletic equipment, as indicated on the drawings and as specified herein. Athletic equipment shall include, but not be limited to:

1. 30’ x 60’ Solid Surface Batter’s Eye with Ribbed Profile Wall Panels and Exposed Fasteners

1.02 RELATED WORK

A. Examine contract documents for requirements that affect work of this section. Other specification divisions and sections that directly relate to the work of this section include, but are not limited to:

1. Division 03 – Concrete; Sections: Cast-in-Place Concrete
2. Division 31 – Earthwork; Sections: Excavation and Backfill and Establishment of Sub-Grade Elevations
3. Division 32 – Exterior Improvements; Sections: Athletic and Recreational Surfacing, Concrete and Asphalt

1.03 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. National Federation of State High School Associations (NFHS)
2. National Collegiate Athletic Association (NCAA)
3. International Association of Athletics Federations (IAAF)
4. American Sports Builders Association (ASBA)
5. Manufacturers Data and Recommended Installation Requirements

1.04 SUBMITTALS

A. Manufacturers Product Data

1. Provide manufacturers product data prior to actual field installation work, for Architects or Owners representatives review.

B. Shop Drawings

1. Provide drawings of the manufacturers recommended installation and foundation requirements prior to actual field installation work, for Architects or Owners representatives review.

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1.05 QUALITY ASSURANCE

A. Manufacturers warranties shall pass to the Owner and certification made that the product materials meet all applicable grade trademarks or conform to industry standards and inspection requirements.

1.06 PRODUCT DELIVERY AND STORAGE

A. Materials delivered to the site shall be examined for damage or defects in shipping. Any defects shall be noted and reported to the Owners representative. Replacements, if necessary, shall be immediately re- ordered, so as to minimize any conflict with the construction schedule. Sound materials shall be stored above ground under protective cover or in- doors so as to provide proper protection.

PART 2 PRODUCTS

2.01 30’ x 60’ Solid Surface Batter’s Eye with Ribbed Profile Wall Panels and Exposed Fasteners

A. Basis of Design: BESR3060 - 30’ x 60’ Solid Surface Batter’s Eye with Ribbed Profile Wall Panels and Exposed Fasteners as Manufactured and Supplied by Sportsfield Specialties, Inc.

B. COMPONENTS:

1. Overall System Dimensions: 30’H x 60’W
    a. Panel Height: 26’-4”
2. Vertical Structure:
    a. 30’ Height Above Finish Grade
    b. Terminal Uprights:
        i. W10x33 Steel I-Beams
        ii. Black Super Durable Powder Coated Finish
        iii. 5’ Embedment Depth
    c. Center Uprights:
        i. W10x39 Steel I-Beam
        ii. Black Super Durable Powder Coated Finish
        iii. 6’ Embedment Depth
3. Horizontal Structure:
    a. Top Beam:
        i. W10x22 Steel I-Beam
        ii. Black Super Durable Powder Coated Finish
    b. Horizontal Girts:
        i. 4” Square x 11ga Steel Tube
        ii. Bolted to Welded Steel Angles
        iii. Black Super Durable Powder Coated Finish
4. Wall Panels:
    a. Low Ribbed Profile Exposed Fastener Metal Wall Panels
        i. MCBI® PBU 36” W 26 Gauge Metal Panels
        ii. Galvalume® Coated with Signature 300® Two-Coat Fluoropolymer Finish
        iii. Finish Available in Various Standard Colors
        iv. Panels Field Assembled

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b. Top, Bottom and Metal Trim with Attachment Hardware Included (Front Side Only)

5. Includes Side Wind Shield and All Necessary Assembly Hardware
6. Manufacturer to Provide Stamped and Sealed Drawings and Calculations by a Licensed Professional Engineer of Record in the State of Project Location

PART 3 EXECUTION

3.01 INSTALLATION OF EQUIPMENT

A. All Batter's Eye systems shall be installed as recommended per manufacturer's written instructions and as indicated on the drawings. Concrete anchoring foundations to be determined by responsible party based on local soil conditions and building codes. Installer should have a minimum of five (5) Batter's Eye system installations or similar experience in the previous three (3) years.

END OF SECTION

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SECTION 118129

FACILITY FALL PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-penetrating railing system for roof edge fall protection.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Material, equipment, and fixture lists. Manufacturer’s catalog data indicating the sizes, descriptions, capacities, test certifications, and other descriptive data showing in sufficient detail that product complies with contract requirements. Equipment and performance data including but not limited to lifeline anchors, safety tieback anchors, and lifeline cable.

C. Shop Drawings: Installation details: plan showing locations and types of anchorage points for personal fall protection systems.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Delegated Design Documents: Drawings and calculations sealed by Designer for fall protection system, indicating compliance with performance requirements and design criteria.

F. Manufacturer's Installation Instructions: Instructions indicating recommended method and sequence of installation for lifeline anchors, safety tieback anchors, energy-absorbing devices, and lifeline cable.

G. Manufacturer's qualification statement.

H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

I. Designer's qualification statement.

J. Installer's qualification statement.

1.3 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

C. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

D. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 NON-PENETRATING RAILING SYSTEM FOR ROOF EDGE FALL PROTECTION

A. Manufacturers:

1. Delta Prevention.
2. BlueWater Mfg.
3. Hy-Safe Technology.
4. Pro-Bel Group.
5. SafePro.
6. Safety Rail Company, LLC.
7. Safety Rail Source.
8. Substitutions: See Section 016000 - Product Requirements.

B. Design Critera:

1. Top Rails and Mid Rails:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
   d. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
   e. Infill load and other loads need not be assumed to act concurrently.

C. Railing Assembly:

1. Railings: 1-1/4 inches OD, galvanized steel tube.
   a. Mounting Height: 42 inches.
2. Mounting Base: Freestanding non-penetrating, cast iron.
3. Surface Protection Pads: EPDM Rubber pads or Bur Pads.
4. Fasteners:
   a. Fastener Materials: Carbon steel.
5. Miscellaneous Materials:
   a. Pipe: ASTM A53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
      1) Provide galvanized finish.
   b. Cast Iron Fittings: Either gray iron, ASTM A48, or malleable iron, ASTM A47, unless otherwise indicated.
6. Steel and Iron Finishes:
   a. Hot-dip galvanize steel railings, including hardware, after fabrication.
   b. Provide hot-dip galvanized fittings, brackets, fasteners, and other ferrous components.
7. Finish: Manufacturer's standard, factory-applied finish.

2.2 MATERIALS - STEEL

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized in accordance with ASTM A153/A153M where connecting galvanized hardware components.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to appearance and performance.

B. Fabricate system components of the same material unless otherwise indicated.

C. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.

D. Fabricate joints in a manner to discourage water accumulation. Provide weep holes to drain all water that could accumulate in the exposed joints.

2.4 FINISHES

A. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.

1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine area for compliance with requirements for installation tolerances and other conditions related to this work.

B. Proceed with installation after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate location of fall protection equipment indicated to be attached to structural substrate or surface of roofing system and provide anchoring devices with templates, diagrams, and installation instructions.

3.3 INSTALLATION

A. Install anchorage and fasteners in accordance with shop drawings and manufacturer's recommendations to obtain allowable working loads published in product literature and in accordance with this specification.

B. Do not load or stress anchors until all materials and fasteners are properly installed and ready for service.

C. Install non-penetrating railing system mounting bases in accordance with manufacturer’s instructions and type of roof in place.

3.4 CLEANING

A. Clean exposed surfaces in accordance with fall protection system manufacturer's written instructions.

END OF SECTION

SECTION 122113

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal faux wood slat louver blinds.

B. Operating hardware.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 061000.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics and operating features.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples, illustrating slat materials and finish, wand type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Cordless Standard: Comply with applicable provisions in ANSI/WCMA A100.1 – Standard for Safety of Window Covering Products and authorities having jurisdiction for openings to receive window covering products.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Horizontal Louver Blinds:

1. Hunter Douglas Architectural
2. Levolor
3. Lotus & Windoware, Inc.
4. SWFcontract, a division of Springs Window Fashions, LLC
5. Substitutions: See Section 016000 - Product Requirements.

2.2 BLINDS

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Cordless control of raising and lowering by push-up and pull-down of bottom bar; blade angle adjustable by control wand.

C. Plastic Slats: Polymer composite, square slat corners.

1. Width: 2 inch.
2. Color: White.
3. Texture: Simulated wood-grain.

D. Slat Support: Woven polypropylene cord, ladder configuration.

E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

F. Bottom Rail: Pre-finished, formed steel; with end caps.

1. Color: Same as headrail.

G. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Removable type.
2. Length of window opening height less 3 inch.
3. Color: As selected by Architect.

H. Headrail Attachment: Ceiling brackets.

I. Accessory Hardware: Type recommended by blind manufacturer.

2.3 FABRICATION

A. Determine sizes by field measurement.

B. Fabricate blinds to fit within openings with uniform edge clearance.

C. Fabricate blinds to cover window frames completely.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 061000.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.4 ADJUSTING

A. Adjust blinds for smooth operation.

3.5 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 123600

COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Sinks molded into countertops.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Natural Stone Institute (NSI) Accredited Natural Stone Fabricator; www.naturalstoneinstitute.org/#sle.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, unfilled, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Manufacturers:
      1) Avonite Surfaces.
      2) Dupont.
      3) Formica Corporation.
      4) Substitutions: See Section 016000 - Product Requirements.
   b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   c. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
   d. Finish on Exposed Surfaces: Semi-gloss, gloss rating of 25 to 50.
   e. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Other Components Thickness: 1/2 inch, minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
5. Fabricate in accordance with manufacturer's standard requirements.

2.2 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:

1. Material: Steel.
2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
3. Color: Black.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 124813

ENTRANCE FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum entrance floor grilles.

B. Recessed frames.

1.2 SUBMITTALS

A. Product Data: Provide data indicating properties of walk-off surface, component dimensions and recessed frame characteristics.

B. Shop Drawings: Indicate dimensions and details for recessed frame.

1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Entrance Floor Grilles and Gratings:

1. Babcock-Davis.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. Substitutions: See Section 016000 - Product Requirements.

2.2 ENTRANCE FLOOR GRILLES AND GRATINGS

A. Entrance Floor Grilles: Recessed extruded aluminum grille assembly with nominal 1 inch wide tread strips running perpendicular to traffic flow, slots between treads, and perimeter frame forming sides of recess; grille hinged for access to recess.

1. Recess Depth: 1 inches.
2. Tread Surfaces: Serrated anodized aluminum.
3. Length in Direction of Traffic Flow: 72 inches.
4. Width Perpendicular to Traffic Flow: Full width of entrance door opening.
5. Frame: Anodized aluminum for embedding in concrete; minimal exposed trim; stud or hook concrete anchors.

B. Mounting: Top of non-resilient members level with adjacent floor.

C. Structural Capacity: Capable of supporting a rolling load of 500 pounds without permanent deformation or noticeable deflection.

D. Vibration Resistant Fabrication: All members welded, riveted, or bolted; no snap or friction connections.

2.3 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor opening for mats are ready to receive work.

3.2 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor recess.

3.3 INSTALLATION

A. Install frames to achieve flush plane with finished floor surface.

B. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

3.4 TOLERANCES

A. Maximum Gap Formed at Recessed Frame From Mat Size: 1/4 inch.

END OF SECTION

SECTION 210000

BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements, as well as the project general requirements for the job.

1.3 PROJECT GENERAL REQUIRMENTS

A. The intent of the drawings and specifications is to provide complete and properly functioning building systems. The Contractor shall provide all labor and material necessary to achieve such ends.

B. The plans and specifications are to be considered complimentary. In case of discrepancies, the most stringent shall apply, as determined by the Engineer.

C. Consider riser diagrams and detail as part of the Contract Documents. Provide equipment, valves, piping and other accessories shown on riser diagrams and details as if they were shown on the floor plans.

D. Provide minor items, accessories or devices as necessary for completion and proper operation of systems, whether or not they are specifically indicated by specifications or drawings.

E. Work that is installed in a method not in accordance with the contract documents, as determined by the Engineer, shall be removed at no additional cost or time penalty to the Owner.

F. The Contractor shall thoroughly examine the contract drawings, visit the site and verify, in the field, all existing conditions before submitting a bid. By the submission of a bid, the Contractor shall acknowledge acceptance of this plan set as an adequate definition of the scope of work and extra cost claims based on inadequacy of plans shall not be considered. No consideration or allowance shall be granted for failure to investigate existing conditions or misunderstandings of the contractual requirements.

G. Definitions: Refer to the drawings and other sections of these specifications for definitions not included below:

1. “Contract Documents”: Complete project specifications and drawings.
2. “Provide”: Furnish and install.
3. “Furnish”: Supply and deliver to the project site.
4. “Install”: Erect in place.
5. “Concealed”: Hidden by walls and/or ceilings.
6. “Exposed”: Visible to view.
7. “Indicated”: Shown in the contract documents.

H. The Contractor shall provide all equipment and materials in accordance with the best engineering practice. Follow the manufacturer's published installation instructions and provide all required auxiliary items. Show all required items on layout drawings.

I. All equipment provided shall be new and the current models for which technical support from the manufacturer and replacement parts are available.

J. All equipment supplied shall be suitable for the purpose intended. All manufacturers shall have had similar products in service for a minimum of three (3) years.

K. Coordinate work and equipment of all sections within Division 21 with work and equipment of other Divisions, to assure complete and satisfactory installation.

1. Perform work, such as: excavation, backfill, concrete, flashing and fire proofing required by Division 21 in compliance with requirements of other applicable Divisions of the specifications.

L. The Contractor shall install all piping parallel to or perpendicular to building walls in a neat workmanlike manner, unless specifically noted. Provide all support steel, hangers, vibration isolation and accessories necessary for equipment per manufacturer's recommendations. Do not support any ceilings or other building structure from piping or appurtenances. Do not allow piping or appurtenances to come into direct contact with building walls or floors. Do not support piping or appurtenances from installed ductwork, other piping, raceways, circuitry, etc. Each installed utility shall be individually supported from the building structure.

M. Where access panels are required for equipment service access, the Contractor shall coordinate final access panel location with equipment location. Access panel sizes shall be sufficient to allow service as indicated in the manufacturer's published operation and maintenance manuals and all applicable codes and standards as adopted and modified by the Authority Having Jurisdiction.

N. Provide openings in building construction for passage of piping. Repair all walls, ceilings and floors, penetrated. Repairs shall be with materials and finishes that match existing construction and as indicated in the Architectural portions of these specifications. Submit floor slab penetration drawings and details as Informational Submittals, for record only.

O. The Contractor shall carefully coordinate the openings in the building as to allow the rigging of the equipment. The fire pumps, controllers, valves, piping and other equipment shall be shipped to the site in sections that shall fit in the openings provided.

P. Field direction that is perceived as different or contradictory to the contract documents shall not relieve the Contractor from complying with the contract documents.

1.4 CONTRACT DRAWINGS

A. Drawings indicate arrangements, approximate sizes and relative locations of major apparatus, equipment, devices and services provided as part of the Work.

1. Check and compare layout of equipment indicated on drawings against all drawings, specifications of all Divisions, and exact locations determined using approved shop drawings of such equipment.

a. Where physical interference occurs, consult with the Engineer and prepare dated, dimensioned drawings correcting such interferences. Submit to the Engineer for review of such drawings.
b. Where physical interference occurs, consult with the Engineer and prepare dated,

dimensioned drawings correcting such interferences. Submit to the Engineer for review of such drawings.

c. Do not scale drawing to determine working dimension. Such measurements shall be taken from figured dimensions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Refer to other divisions of this specification for location of Contractor storage and staging area.

B. Deliver all materials with factory-applied end closures. Maintain end closures through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

C. Protect materials from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

D. Protect equipment, flanges, fittings, and piping specialties from moisture and dirt.

E. Protect open pipe from dirt and debris. Cover all ends of uninstalled pipe and exposed ends of installed pipe.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation other building components.

B. Provide a detailed loaded project Critical path method (CPM) schedule for this Contractors work separately from the general Contractor's CPM, which can be integrated into the GC’s schedule. The Sub-contractors CPM schedule shall show all work associated with the ordering, installation and commissioning of all equipment listed on the drawings by phase/floor as appropriate. This shall be submitted in paper and electronic (PDF) format and approved by the Owner before any request for payment is submitted. Sample tasks to be shown include but are not limited to the following:

1. Shop drawing preparation.
2. Show A/E shop drawing approval period of 3 weeks.
3. Equipment delivery.
4. Installation start by system and floor area.
5. All Testing.
6. Installation complete by system and floor area.
7. Utility Shutdown.
8. Temporary fire protection.
9. Utility connections.
10. Equipment start-up.
11. System fill.
12. Commissioning by system and floor.
13. Training.
14. Payment request.
15. Punch list.

C. Arrange for chases, slots, and openings in building structure during progress of construction to allow for fire suppression work installations.

D. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

F. Coordinate connection of electrical services (of all voltages).

G. Coordinate connection of fire suppression systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

H. Coordinate requirements for access panels and doors where fire suppression items requiring access are concealed behind finished surfaces.

I. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.7 REFERENCED ORGANIZATIONS AND CODES

A. The following list of abbreviations are utilized within the specifications and are provided as a reference:

1. AABC - Associated Air Balance Council.
2. ADA - American Disability Act.
3. AGA - American Gas Association.
4. AHJ - Authority Having Jurisdiction
5. ANSI - American National Standards Institute.
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers.
7. ASME - American Society of Mechanical Engineers.
8. ASPE - American Society of Plumbing Engineers.
9. ASSE - American Society of Sanitary Engineering
10. ASTM - American Society for Testing and Materials.
11. AWWA - American Water Works Association.
12. CS - Commercial Standard.
13. CSA - Canadian Standards Association.
14. EOR - Engineer of Record
15. FM - Factory Mutual Global
16. HI - Hydraulic Institute.
17. IBC - International Building Code.
18. IBR - Institute of Boiler and Radiator Manufacturers.
19. IECC - International Energy Conservation Code.
20. IEEE - Institute of Electrical and Electronics Engineers.
21. ITM - Inspection, Testing, and Maintenance as specified in NFPA 25.
22. MSSP - Manufacturers Standards Society of the Valve and Fittings Industry.
23. NEC - National Electrical Code.
24. NEMA - National Electrical Manufacturers Association.
25. NICET - National Institute for Certification in Engineering Technologies
26. NFPA - National Fire Protection Association.
27. NSF - NSF International
28. OSHA - Occupational Safety and Health Administration.
29. PHCC - National Standard Plumbing Code Illustrated.
30. SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
31. TEMA - Tubular Exchanger Manufacturers Association.
32. UL - Underwriters' Laboratories.

1.8 PRE-BID SITE VISIT

A. Prior to preparing the bid, the Contractor shall visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and all other matters that can affect the work. No additional compensation shall be made to the Contractor as a result of his failure to familiarize himself with the existing conditions under which the work must be performed.

1.9 OUTAGES

A. For all work requiring an outage, the Contractor shall submit an outage request to the Owner and Architect in enough time to allow a 3 week review or as required by Division 1. The outage request shall include as a minimum:

1. System(s) effected.
2. Proposed isolation points.
3. Start and duration of outage.
4. Contractor contact person.
5. Emergency procedures.
6. Method of procedure.

B. All mechanical outages, which will interfere with the normal use of the building in any manner, shall be done at such times as shall be mutually agreed upon by the Contractor and the Owner.

C. The Contractor shall include in his price the cost of all premium time required for outages and other work to be performed, which interferes with the normal use of the building.

D. The operation of valves or switches required to achieve an outage must be accomplished by the Owners personnel only. Prospective Sub-contractors under this section are cautioned that the unauthorized operation of valves, power switches, or other control devices by their personnel can result in extremely serious consequences for which the Contractor shall be held accountable.

1.10 CUTTING, WELDING, BURNING

A. Before the Contractor commences any cutting, welding, burning, brazing or pipe sweating, the Contractor shall obtain a hot work permit from the Owner.

B. The hot work permit copy shall remain on the job site at the hot work location until such work is completed.

1.11 PERFORMANCE REQUIREMENTS

A. Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.

B. Furnish and install all items as may be required to fit the work to the conditions encountered.

C. Arrange piping, valves, equipment and other work generally as shown on the contract drawings, providing proper clearances and access.

D. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawing submittal for approval in accordance with Submittals specified below.

E. The Owner may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication at no charge and with no time extension.

F. Equipment submitted that is not basis of design must meet all specified/scheduled performance criteria. No additional compensation shall be made to the Contractor if substituted equipment does not meet performance criteria.

1.12 MATERIALS AND EQUIPMENT

A. The contract drawings and system performances have been designed on the basis of using the particular manufacturer's products specified or scheduled on the contract drawings.

B. All proposed substitutions shall be reviewed by the Engineer. The determination of equal products to the prototype shall be at the sole discretion of the Engineer.

C. Products of other manufacturer's listed in the specification shall be permitted provided as follows:

1. Product shall meet the specifications. If the contractor intends to use a product or equipment not explicitly defined in the project specifications, they shall submit to Substitution Request to the Owner/Architect/Engineer in writing for review and approval.
2. Any substitutions for the approved product shall require the contactor to make all required changes to all associated trades to accommodate the substitution at no cost or time impact to the project. All substitutions shall be provided with a benefit to the Owner in the form of a credit, reduction in construction schedule, or other advantage approved by the Owner. Substitutions submitted for review without a credit or stated benefit shall be returned "Rejected/Resubmit".
3. All changes shall be made, without additional cost to the Owner or effort by the design team. The Contractor shall be responsible to provide all adjustments for deviations, such that the final installation is complete and functions as the basis of design product is intended. For equipment substitutions, the Contractor shall make all required accommodations to utilize unit selected, at no additional cost to Owner including but not limited to:

    a. Electrical modifications including circuit breaker fuse, disconnect switch, conduit and wire size.
    b. Structural modifications.
    c. Providing National Electrical Code (NEC) and Authority Having Jurisdiction (AHJ) required service clearances.
    d. Space requirements with all other trades if physical dimensions are different than shown in the construction documents.

D. Products with dimensions or other characteristics different from the basis of design product that render their use impractical or cause functional fit, access, or connection problems, shall not be acceptable.

1.13 DELEGATED DESIGN REQUIREMENTS

A. All shop drawing submittals associated with fire suppression systems shall be signed and sealed by the contractor's delegated design professional responsible for the project. Said individual must hold a current Fire Protection Engineer license from the State where the project will be constructed. Contractor must provide supporting documentation for their delegated design professional within three (3) weeks of the award of contract. Documentation shall include but not limited to a copy of their current license or wallet card, a signed detailed resume documenting a minimum of five (5) year's experience in fire suppression design, and a detailed project completion history containing a minimum of three (3) projects where they were personally responsible for design.

1.14 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "Submittals," except as modified below.

B. The purpose of the submittal process is to show, via products, shop drawings, performance data, and calculations, how the Contractor shall conform to the contract documents.

C. Shop drawing review by the Engineer of Record is only for the limited purpose of checking for conformance with the information given in the construction documents. Review is not conducted for the purpose of determining the accuracy of or completeness such as dimensions or quantities.

D. The Contractor shall submit shop drawings, coordination drawings, fabrication drawings and receive acceptance from the Engineer of Record prior to submission to the Authority Having Jurisdiction for trade permit, construction or ordering of same.

E. Acceptance by Engineer of Record does not absolve Contractor of code or Authority Having Jurisdiction's requirements. Conversely, approval by the Authority Having Jurisdiction does not absolve the Contractor of satisfying the requirements of the contract documents.

F. Submittals must clearly indicate the specific products, accessories and where they shall be used on this project. Submittals that do not contain the above information shall be rejected.

G. Submittals shall be reviewed by the Contractor and bear his stamp that the submittal meets the requirements of the contract documents. Submittals that are not stamped shall be rejected as they will not have proof that the Contractors have adequately reviewed the submittal for compliance with the contract documents.

H. Submittals shall be reviewed by the Engineer of Record for 'Informational Purposes Only'. If the Engineer of Record finds a submission to be in non-conformance with the contract documents and specifications for the project it will be returned to the contractor with an itemized list of observed deficiencies including recommended corrective actions to obtain compliance.

I. Return of an 'Make Corrections Noted' submittal does not require resubmission to the Engineer of Record for re-review but rather acknowledgement in writing from the Contractor that they will make the corrective actions noted prior to construction and include them in the Record Documents.

J. Submittals shall be reviewed not more than two (2) times. If the Contractor fails to submit shop drawings that are approved by the Engineer of Record within the first two attempts, he shall be back charged at a current rate of the Engineer of Record’s hourly contact rate for all subsequent reviews.

K. Resubmittals must be accompanied by an itemized response letter authored and signed by the delegated design professional on their company letterhead. Each revision shall be clouded on plan and thoroughly explained in the response letter. 'Will Comply' is not an acceptable response.

L. The Engineer of Record reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received, independent of all pre-determined project specific submittal review times and schedules.

M. Submit samples of color, lettering style, and other graphic representation required for each identification material and device.

N. Shop drawings shall include detailing, fabrication, and installation information for all supports and anchorage required for each specific fire suppression material and/or piece of equipment.

O. If the fire protection contractor proposes to use welded pipe and fittings, they shall provide welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article and all applicable requirements of NFPA 13.

P. Fire protection submittals shall be one complete package including but not limited to scaled plans, all material data as outlined in the project specifications, NFPA 13 format hydraulic calculations with detailed worksheets, a current hydrant flow test data on municipality's official report sheet, and a letter authored and signed by the delegated design professional noted above stating they have reviewed and approved the design package in conformance with all applicable codes, standards, and all contract documents. Equivalent k-factor method not permissible for use in hydraulic calculations. Incomplete submittals will be automatically rejected.

1.15 COORDINATION DRAWINGS

A. Coordination drawings shall be submitted as an “Informational Submittal.” Informational Submittals shall be written and graphic information and physical samples that do not require Architect's responsive action. Submittals will be reviewed for conformance with specified requirements. Submittals may be rejected for not complying with these specified requirements

B. Prepared coordination drawings [and update BIM model] in accordance with Division 1 to a scale of 1/4"=1'-0" or larger aligned to the architect's project specific sheet size and layout; detailing major elements, components, and systems of fire suppression equipment and materials in relationship with other systems, installations, and building components. Locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work shall be indicated. Said drawings shall include, but not necessarily be limited to the following:

1. Details regarding the proposed locations of piping, valves, equipment, and materials including, but not limited to the following:

    a. All sizes, shapes, connection points, service clearances, weights, support points of each proposed piece of equipment and the structure, adjacent equipment.
    b. Specific equipment proposed by the contractor and not just generic prototype equipment coordinated with the product data submittal.
    c. Planned piping layout, including valve and specialty locations and valve stem movement.
    d. Clearances for installing and maintaining systems and components.
    e. Clearances for servicing and maintaining equipment, and space for equipment disassembly required for periodic maintenance.
    f. Equipment connections and support details.
    g. Exterior wall and foundation penetrations.
    h. Fire-rated wall and floor penetrations.
    i. Sizes and location of required concrete pads and bases.
    j. Access doors.
    k. Name of owner and occupant.
    l. Project location including street address.
    m. Point of compass.
    n. Full height cross section, or schematic diagram, including structural member information if required for clarity including ceiling construction and method of protection for non-metallic piping.
    o. Location of partitions.
    p. Location of fire walls.

q. Occupancy class of each area or room.
r. Location and size of concealed spaces, closets, attics, and bathrooms.
s. Any small enclosures in which no sprinklers are installed.
t. Other sources of water supply, with pressure or elevation.
u. Make, type, model, and nominal K-factor of sprinklers including sprinkler identification number.
v. Temperature rating and location of high-temperature sprinklers.
w. Total area protected by each system on each floor.
x. Number of sprinklers on each riser per floor.
y. Total number of sprinklers on each dry pipe system, preaction system, combined dry pipe-preaction system, or deluge system.
z. Approximate capacity in gallons of each dry pipe system.
aa. Pipe type and schedule of wall thickness.
bb. Nominal pipe size and cutting lengths of pipe (center-to-center dimensions). Where typical branch lines prevail, it shall be necessary to size only one typical line.
cc. Location and size of riser nipples.
dd. Type of fittings and joints and location of all welds and bends. The contractor shall specify on drawing any sections to be shop welded and the type of fittings or formations to be used.
ee. Type and locations of hangers, sleeves, braces, and methods of securing sprinklers when applicable.
ff. All control valves, check valves, drain pipes, and test connections.
gg. Make, type, model and size of alarm or dry pipe valve.
hh. Make, type, model and size of preaction or deluge valve.
ii. Kind and location of alarm bells.
jj. Size and location of standpipe risers, hose outlets, hand hose, monitor nozzles, and related equipment.
kk. Piping provisions for flushing.
ll. Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear.
mm. For hydraulically designed systems, the information on the hydraulic nameplate.
nn. A graphic representation of the scale used on all plans.
oo. Name and address of contractor.
pp. Hydraulic reference points shown on the plan that correspond with comparable reference points on the hydraulic calculation sheets.
qq. The minimum rate of water application (density or flow or discharge pressure), the design area of water application, in-rack sprinkler demand, and the water required for hose streams both inside and outside.
rr. The total quantity of water and the pressure required noted at a common reference point for each system.
ss. Relative elevations of sprinklers, junction points, and supply reference points.
tt. If room design method is used, all unprotected wall openings throughout the floor protected.
uu. Calculation of loads for sizing and details of sway bracing.
vv. The setting for pressure reducing valves.
ww. Information about flexible sprinkler drops including but not limited to manufacturer specific installation requirements.
xx. Ceiling /roof heights and slopes not shown in the full height cross section/
yy. Edition year of NFPA standards the fire suppression systems are design to.
zz. Any other information required for working drawings as required by codes and standards referenced in the contract documents.

aaa. Fire pump flow test data performed within 12 months of the submittal data to be used for calculation purposes.

2. Details regarding scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations. Show all wall mounted access doors for fire suppression devices and equipment.
4. Coordinated reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, cable trays, sprinkler heads, access doors and other ceiling-mounted items.
5. Provide Information Submittals of drawings for the work that shall be solely for the benefit of the Contractor and shall not be reviewed including:

a. Sleeve drawings.

1.16 UNDERWRITER'S LABORATORY (UL) REQUIREMENTS

A. All equipment containing electrical components and provided as part of the mechanical specifications shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.

1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a UL label at the installer's expense.
2. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.

1.17 FIRE SAFE MATERIALS

A. Unless otherwise indicated, materials shall conform to UL, NFPA or ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of twenty five (25) and smoke developed of fifty (50).

1.18 COLOR SELECTION

A. Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.

1.19 VARIANCES

A. Where variances occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract price. The Engineer shall decide on the item and manner in which the work shall be provided.

1.20 STANDARD OF QUALITY

A. Provide materials that comply with quality, style and sizes specified and shown on Drawings.

1. Manufacturer's names and model numbers may be stated in contract documents for the purpose of establishing standards of quality, style, size and type, and shall not be construed to exclude equipment or materials of other acceptable manufacturers, subject to compliance with contract requirements.
2. Where a specific manufacturer is specified, provide specified item of product of one of other acceptable manufacturer where permitted, provided that alternate item conforms in all respects to Indicated requirements.

a. Consideration will not be given to claims that another manufacturer's item meets performance requirements with lesser construction.
b. Performance as delineated on contract drawings and in specifications shall be interpreted as minimum performance requirements.
c. Provide documentation that compares each specific characteristic of the specified manufacturer's product to that of the proposed "acceptable manufacturer's" product.

1.21 GUARANTEE/WARRANTY:

A. All materials, equipment, etc. provided by the Contractor shall be guaranteed and warranted to be free from defects in workmanship and materials for a period of two (2) years after date of substantial completion and acceptance of work by the Owner or as required by Division. 1. Any defects in workmanship, materials, or performance which appear within the guarantee period shall be corrected by the Contractor without cost to the Owner, within a reasonable time. In default thereof, Owner may have such work done and charge the cost of same to the Contractor. Any special warranties shall be as detailed in relevant specification sections. Manufacturer's standard warranties shall not absolve Contractor of specification requirements.

1.22 EQUIPMENT PROVIDED UNDER ANOTHER DIVISION AND BY OTHERS

A. The Installer of products under Division 21 shall make all system connections required to equipment furnished and installed under another division and by others.

B. It shall be the responsibility of the Installer to obtain all necessary data from the equipment supplied under other Divisions.

1.23 AS BUILT DRAWINGS

A. Upon completion of the fire suppression installations, the Installer shall deliver to the Architect five (5) complete sets of marked-up blueprints and electronic PDF of as-built conditions.

1. The mark-ups shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design.
2. All mark-ups shall be made on the contract set of documents.
3. Refer to General Requirements of Division 1 for additional requirements pertaining to Submittals and Record Drawings.

1.24 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "Closeout Procedures". In addition to the requirements specified in Division 1, indicate the following installed conditions on the Contract Drawings:

1. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Maintenance clearances and access points.
4. Numbering coordinated with contract documents and O&M manuals.
5. Approved substitutions, Contract Modifications, Responses to Contractor's Request for Information, and actual equipment and materials installed.

B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located to record the locations and invert elevations of underground installations.

1.25 CLOSEOUT PROCEDURES

A. Prepare operations and maintenance manuals in accordance with Division 1 Section "Project Closeout." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Periodic maintenance schedule.
2. Parts list.
3. Parts supplier listing.
4. Service diagrams.

B. The Contractor shall provide six (6) bound copies of manufacturer's published operating and maintenance instructions for all serviceable equipment provided under this contract at least two (2) months prior to Substantial Completion. Operating and maintenance instructions shall be presented to the design engineer bound in three ring binders, tabbed by system and as electronic PDF on a flash drive, before the pre-final review of construction.

1. List of systems and equipment requiring service manuals.
2. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
3. Manufacturer's printed operating procedures to include start-up, run-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
5. Servicing instructions and lubrication charts and schedules.
6. Systems and equipment test reports.
7. All warranties for equipment installed on this project (minimum 2 years). Warranty letters shall be provided on company letterhead and detail the scope, duration, and extents of coverage.
8. A detailed company directory of key project personnel with contact information including but not limited to company's Estimator, Project Manager, Superintendent, Foreman, Designated Design Professional, and Service Manager.
9. Contractor's workmanship and materials warranty.
10. Start-up report in readable legible fashion.
11. Letter of Completion stating that installation is 100% complete per applicable codes and standards to satisfy all requirements of the contract documents. Letter shall be signed by the active president of the organization.
12. Copies of all permits with closeout documentation (green stickers, reports, etc.)
13. Sign-in sheets for all owner training presentations.

C. Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals, including a customized list of preventive maintenance items and annual schedule for maintenance.
2. Record documents.
3. Complete inventory of spare parts and materials.
4. Tools.

5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

D. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start up.
2. Shut down.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Maintenance operations per NFPA 25.

E. Provide all commissioning reports.

F. Submit all documentation and obtain approval as required for LEED certification.

1.26 PROJECT PUNCH OUT

A. Architect/Engineer shall perform punch out reviews and shall provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer shall not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement shall be made by deducting the Architect/Engineer fee from the Contractor's final payment.

PART 2 - PRODUCTS

2.1 CONCRETE AND MASONRY WORK

A. Concrete: 3,500 psi compressive strength after twenty eight (28) days.

2.2 GROUT

A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post hardening, volume adjusting, dry, hydraulic cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.50MPa), twenty eight (28) day compressive strength
3. Packaging: Premixed and factory-packaged

2.3 ACCESS DOORS AND PANELS

A. Provide manufactured steel door assemblies consisting of:

1. Hinged door.

2. Flush screwdriver cam locks and frame.
3. Appropriate fire-rating where applicable.

B. Doors shall be Milcor Metal Access doors or approved equal. Provide key locks where indicated.

C. Design shall be provided for the following installations:

1. Acoustical or Cement Plaster: Style B.
2. Hard Finish Plaster: Style K or L.
3. Masonry or Dry Wall: Style M.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications included in the mechanical specifications for equipment rough in requirements.

3.2 INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate fire suppression systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for fire suppression installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible. Notify the Owner prior to installation when headroom is less than 7'-6".
7. Coordinate connection of fire suppression systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
10. Install fire suppression equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in the Division 8 specifications.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Sections. In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of fire suppression equipment and materials required to:

1. Uncover Work to provide for installation of Out-of-Sequence Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Commission the Work.

C. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

D. Cut, remove and legally dispose of selected fire suppression equipment, components, and materials as indicated, including but not limited to removal of piping, fire suppression fixtures and trim, and other fire suppression items made obsolete by the new Work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1. Patch finished surfaces and building components using new materials specified for the original installation and using experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

a. Refer to Division 1 Section "Definitions and Standards" for definition of "Experienced Installer".

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for field painting requirement.

B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Do not paint manufacturer's labels or tags.

3.5 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated, but not less than four (4) inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting

templates for anchor bolt and tie locations. Use 3000-psi, twenty eight (28) day compressive strength concrete and reinforcement bars as specified in the architectural specifications. Housekeeping pads shall be 4-inches in height except for air handling units. For air handling units, housekeeping pad shall be at a depth to allow p-trap installation per manufacturer's requirements and for service access beneath installed p-trap.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel"

3.7 DEMOLITION

A. Disconnect, demolish, and remove work specified as part of the mechanical specifications and as indicated. Remove pipes and ducts back to the active pipe and duct to remain and cap.

B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Abandoned Work: Cut and remove buried pipe abandoned in place, two (2) inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from the Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.8 GROUTING

A. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.

B. Clean surfaces that come into contact with grout.

C. Provide forms for placement of grout, as required.

D. Avoid air entrapment when placing grout.

E. Place grout to completely fill equipment bases.

F. Place grout on concrete bases to provide a smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's printed instructions.

3.9 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.

B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.10 CLEANING AND FINISHES

A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.

B. Provide factory applied finish where specified.

C. Protect all finishes, and restore all finishes to their original condition if damaged as a result of work installed as part of the mechanical specifications.

D. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces.

3.11 PROTECTION OF WORK

A. Protect work, material and equipment from weather and construction operations before and after installation.

B. Properly store and handle all materials and equipment.

C. Cover temporary openings in piping, ductwork and equipment to prevent the entrance of water, dirt, debris, and other foreign matter.

3.12 ELECTRICAL REQUIREMENTS

A. Coordinate selection of fire suppression equipment requiring electrical connections (of all voltages) with other specification sections. Coordinate installation closely with all other trades to facilitate electrical connections in a code compliance manner for project delivery in compliance with contract documents. In general, power wiring and motor starting equipment shall be provided as specified in the electrical specifications.

1. Where the electrical requirements of the equipment furnished differ from the provisions made in the electrical specifications, make the necessary allowances as part of the fire suppression specifications.
2. Where no electrical provisions are included in the electrical specifications, include all necessary electrical work as part of the fire suppression specifications. Notify Engineer of Record immediately.

3.13 PROVISIONS FOR ACCESS

A. Furnish and install adequate access to all fire suppression components. The following list shall be used as a guide only:

1. Equipment.
2. Valves.
3. Controls.
4. Any and all fire suppression appurtenances required for ITM, no matter the frequency.

B. Access shall be adequate as determined by the Architect.

C. Refer to contract drawings where access panels have been specifically located.

D. Provide additional access panels for adequate access to equipment and components as indicated in paragraph ‘A’ above.

E. Where access is by means of lift out ceiling tiles or panels mark each access panel, using small color coded or numbered tabs. Provide an index chart for identification. Place markers in corner of tile.

3.14 PENETRATION OF WATERPROOF CONSTRUCTION

A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.

B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.15 OPERATION OF EQUIPMENT DURING CONSTRUCTION

A. Clean all systems and equipment prior to initial operation for testing and commissioning.

B. Do not operate equipment unless all proper safety devices or controls are operational.

C. Provide all maintenance and service for equipment which is operated during construction.

D. Provide the services of a manufacturer's factory trained service organization to start the equipment. Submit testing report prior to equipment demonstration.

E. Do not use fire suppression systems for temporary services during construction unless authorized in writing by the Architect.

F. Upon completion of work, clean and restore all equipment to new conditions and replace all covers, filters, clean strainers and flush systems just prior to equipment demonstration.

3.16 SPARE PARTS

A. Provide spare for systems provided under this project including but not limited to:

1. See specific Div 21 specifications for details.

3.17 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of equipment and systems to Owner’s personnel a minimum two (2) weeks prior to date of final inspection. Correct any difficulties prior to requesting final inspection.

1. For equipment requiring seasonal operation, perform instructions for other seasons at the same time.
2. Training period shall be performed within one (1) week period.

B. Contractor shall pre-test all equipment prior to requesting demonstration and instruction.

C. Use operation and maintenance manuals and videos as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation and maintenance.

D. Provide sign-in sheet for each training conducted.

E. Demonstrate the following:

1. Start up.
2. Operation.
3. Control.
4. Adjustment.
5. Trouble shooting.
6. Servicing.
7. Maintenance.
8. Shutdown.

F. Provide at least sixteen (16) hours straight time instruction to the operating personnel.

1. This instruction period shall consist of not less than two (2), eight (8) hour days.
2. Time of instruction shall be designated by the Owner.

3.18 LUBRICATION

A. All bearings, motors and all equipment requiring lubrication shall be provided with accessible fittings.

B. Before turning over the equipment to the Owner, the Installer shall provide the following:

1. Fully lubricate each item of equipment.
2. Provide one (1) year's supply of lubricant for each type of lubricant.
3. Provide complete written lubricating instructions, together with diagram locating the points requiring lubrication.

C. Motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal extended grease fittings and drain plugs.

3.19 WALL AND FLOOR PENETRATION

A. All penetrations of partitions, walls and floors by ducts, piping or conduit under Division 21 shall be sealed and caulked. Provide U.L. listed fire stopping systems at penetrations through fire walls as specified in the architectural specifications.

3.20 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section “Temporary Facilities.”

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

C. Remove all mechanical clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

END OF SECTION 21 00 00

SECTION 210523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Trim and drain valves.

1.2 DEFINITIONS

A. SBR: Styrene-butadiene rubber.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Fire Main Equipment: HAMV - Main Level.
   a. Ball Valves, System Control: HLUG - Level 3.
   b. Butterfly Valves: HLXS - Level 3.
   c. Check Valves: HMER - Level 3.
   d. Gate Valves: HMRZ - Level 3.

2. Sprinkler System and Water Spray System Devices: VDGT - Main Level.

   a. Valves, Trim and Drain: VQGU - Level 1.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:
   a. Valves.

      1) Gate valves.
      2) Check valves.
      3) Miscellaneous valves.

C. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B31.9 for building services piping valves.

D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

E. NFPA Compliance for Valves:

1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.

F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.

2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Ames Fire & Waterworks; A Watts Water Technologies Company.
2. NIBCO INC.
3. Victaulic Company.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ALEUM USA.
2. Globe Fire Sprinkler Corporation.
3. Milwaukee Valve Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly type, Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Stainless steel with EPDM coating.
7. Actuator: Worm gear.

Retain "Supervisory Switch" Subparagraph below only if switch is not specified elsewhere.

8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2 : Threaded ends.
10. Ends Connections for Valves NPS 2-1/2 : Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Globe Fire Sprinkler Corporation.
2. Kennedy Valve Company; a division of McWane, Inc.
3. NIBCO INC.
4. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
5. Victaulic Company.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with epoxy coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, and EPDM coated.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.6 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Mueller Co. LLC; Mueller Water Products, Inc.
3. NIBCO INC.
4. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
5. Victaulic Company.
6. Viking Group Inc.
7. WATTS; A Watts Water Technologies Company.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 BRONZE OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Milwaukee Valve Company.
2. NIBCO INC.
3. United Brass Works, Inc.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.8 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Milwaukee Valve Company.
b. NIBCO INC.
c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
d. Victaulic Company.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.
d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Fire Protection Products Inc (FPPI); a brand of Anvil International and Smith-Cooper International.
b. NIBCO INC.
c. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig**.**
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. NIBCO INC.
b. United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:

1. Section 211000 "Water-Based Fire-Suppression Systems" for application of valves in fire-suppression standpipes; wet-pipe, fire-suppression sprinkler systems; and dry-pipe, fire-suppression sprinkler systems.
2. Section 331415 "Site Water Distribution Piping" for application of valves in fire-suppression water-service piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.

C. Install double-check valve assembly in each fire-protection water-supply connection.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 210523

SECTION 210529

HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fastener systems.
4. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 13.

B. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. ITW Ramset/Red Head; Illinois Tool Works, Inc.

2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

2.5 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.6 MATERIALS

A. Carbon Steel: ASTM A1011/A1011M.

B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

C. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components, weight of water in pipe and plus 250 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

G. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup:

1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Install pipe hangers per NFPA 13.

END OF SECTION 210529

SECTION 210553

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe labels.
2. Valve tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: Provide for fire-suppression piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include the following:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.

2.2 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.04 inch thick, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting." Paint all exposed piping ANSI red.

B. Install pipe labels on hidden pipe showing service and flow direction with permanent adhesive on pipes.

C. Pipe-Label Locations: Locate pipe labels where piping is above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit a view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

D. Flow- Direction Arrows: Provide arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Fire-Suppression Pipe Label Color Schedule:

1. Fire-Suppression Pipe Labels: White letters on an ANSI Z535.1 safety-red background.

3.4 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification "FSV" on all fire-suppression system valve tags.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.

1. Valve-Tag Size and Shape:
   a. Fire-Suppression Standpipe: 2 inches, round.
   b. Wet-Pipe Sprinkler System: 2 inches, round.
   c. Dry-Pipe Sprinkler System: 2 inches, round.
   d. Clean-Agent Fire-Extinguishing System: 2 inches, round.
   e. Preaction System: 2 inches, round.

2. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background.

END OF SECTION 210553

SECTION 210800

COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes Cx process requirements for the following fire-suppression systems, assemblies, and equipment:

1. Water-based fire-suppression systems.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For construction checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

1.2 DEFINITIONS

A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

C. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fire-suppression testing technician.

B. Construction Checklists:

1. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Contractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and NFPA 3 and to resolve any issues with the CxA.
2. Cx plan, including material, installation, and performance construction checklists for systems, assemblies, subsystems, equipment, and components relating to fire-suppression system to be part of the Cx process and in accordance with requirements in Section 019113 "General Commissioning Requirements" and NFPA 3.

C. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Contractor, provide the following:

1. Equipment/instrument identification number.

2. Planned Cx application or use.
3. Manufacturer, make, model, and serial number.
4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:

    a. Instrument or tool identification number.
    b. Equipment schedule designation of equipment for which the instrument or tool is required.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.4 QUALITY ASSURANCE

A. Fire-Suppression Testing Technician Qualifications: Technicians to perform fire-suppression Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:

1. Journey level or equivalent skill level with knowledge of fire-suppression system, electrical concepts, and building operations.
2. Minimum three years' experience installing, servicing, and operating systems manufactured by approved manufacturer.

B. Testing Equipment and Instrumentation Quality and Calibration:

1. Capable of testing and measuring performance within the specified acceptance criteria.
2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
3. Be maintained in good repair and operating condition throughout duration of use on Project.
4. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

C. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

    a. Be calibrated by manufacturer with current calibration tags permanently affixed.
    b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
    c. Fire-suppression system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Cx PROCESS

A. Perform Cx process for fire-suppression system in accordance with the following:

1. Section 019113 "General Commissioning Requirements."
2. NFPA 3.

3.2 CONSTRUCTION CHECKLISTS

A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each fire-suppression system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in NFPA 3. Contractor performs the following:

1. Review fire-suppression system preliminary construction checklists and provide written comments on Construction Checklist items where appropriate.
2. Return preliminary Construction Checklist with review comments within 10 days of receipt.
3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
4. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

B. Prepare preliminary detailed construction checklists for each fire-suppression system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in NFPA 3.

1. Submit preliminary construction checklists to CxA and Designer for review.
2. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
3. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

C. Additional Systems Required to Be Commissioned:

1. Fire-suppression standpipes, including the following:

a. Fire-suppression water piping, fittings, and specialties inside the building.
b. Pressure-maintenance pumps, motors, accessories, and controls.
c. Meters and gauges.
d. General-duty and specialty valves.
e. Hangers and supports.
f. Identification.

2. Fire-suppression sprinkler systems, including the following:

a. Wet-pipe sprinkler piping, fittings, sprinklers, and specialties.
b. Dry-pipe sprinkler piping, fittings, sprinklers, and specialties.
c. Pressure-maintenance pumps, motors, accessories, and controls.
d. Compressed-air piping, compressors, motors, accessories, and controls.
e. Sleeves and sleeve seals.
f. Meters and gauges.
g. General-duty and specialty valves.
h. Hangers and supports.
i. Identification.

3. Documentation:

a. Fire-suppression system operating manuals.
b. Documentation of required Cx.
c. Documentation of required operator training.

3.3 Cx TESTING PREPARATION

A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.

B. Certify that fire-suppression system instrumentation and control systems have been completed and calibrated, that they are operating in accordance with the Contract Documents and approved submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.4 Cx TEST CONDITIONS

A. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.

C. If seasonal testing is specified, complete appropriate initial performance tests and documentation, and schedule seasonal tests.

3.5 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS

A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.

B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response compared to acceptance criteria.

C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.

D. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance test requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.

E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

1. Cx Construction Checklist verification tests.
2. Cx Construction Checklist verification test demonstrations.

3.6 CONSTRUCTION CHECKLIST EXAMPLES

A. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:

1. Prerequisites: Acceptance of results of construction checklists for valves specified in the following Sections:

    a. Section 210523 "General-Duty Valves for Water-Based Fire Protection Piping."
    b. Section 211000 "Water-Based Fire-Suppression Systems."
    c. Section 284621.11 "Addressable Fire-Alarm Systems."

2. Equipment and Systems to Be Tested:

    a. Supervised valves in water-based fire-suppression systems.
    b. Division 28 fire-detection and -alarm systems.

3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
4. Test Conditions:

    a. Fire-alarm system operating in normal, automatic mode.
    b. Activate valve supervision devices and tamper switches, one at a time.

5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.

3.7 Cx TESTS FOR DRY-PIPE SPRINKLER PIPING, FITTINGS, SPRINKLERS, AND SPECIALTIES

A. Air Compressor Run Time:

1. Prerequisites: Acceptance of results of construction checklists specified in Section 211316 "Dry-Piping Sprinkler Systems."
2. Systems and Equipment to Be Tested:

    a. Air compressors in fire-suppression systems.
    b. Associated compressed air piping, valves, and appurtenances.
    c. Associated air pressure controllers.

3. Test Purpose: Evaluate air compressor run time and number of compressor starts.
4. Test Conditions:

    a. Keep compressed air and associated sprinkler piping openings closed during test.
    b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
    c. Record number of air compressor motor starts during a 14-day period.
    d. Record air compressor motor run time during the same 14-day period.

5. Acceptance Criteria:

    a. Number of compressor motor starts during test period shall not exceed 20.
    b. Compressor motor run time during test period shall not exceed 60 minutes.

END OF SECTION 210800

SECTION 211000

WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-suppression piping, fittings, and appurtenances.
2. System control valves.
3. Dry-sprinkler system nitrogen generator with purge/vent.
4. Fire-suppression piping specialties.
5. Sprinklers.
6. Pressure gauges.

1.2 DEFINITIONS

A. Standard-Pressure Fire-Suppression System Piping: Piping designed to operate at working pressure of 175 psig maximum.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles.
b. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:

1. Prepare in accordance with NFPA 13 section "Working Plans."

a. Include plans, elevations, and sections of the system piping and details.
b. Include detailed riser diagram and schematic diagram showing system supply, supply connection, devices, valves, pipe and fittings, as well as the delineation of the standard-pressure and high-pressure portions of the fire-suppression system.
c. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Prepare computer-generated hydraulic calculations in accordance with the following:
   a. Name of hydraulic program used.
   b. Water supply information, including fire hydrant flow test data report.

3. Submit documents and calculations signed and sealed by qualified professional engineer responsible for their preparation.
4. Include diagrams for power, signal, and control wiring.

D. Delegated Design Submittals: For fire-suppression systems indicated to comply with performance requirements and design criteria, including analysis data, signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Fire-suppression system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Seismic Qualification Certificates: For fire-suppression equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Qualification Data: For qualified Installer and professional engineer

D. Design Data: Approved fire-suppression piping working plans, prepared in accordance with NFPA 13, including documented approval by AHJs, and including hydraulic calculations if applicable.

E. Welding certificates.

F. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire pump test report completed no more than 12 months before shop drawing submission..

G. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-suppression systems and specialties to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
2. System control valves.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code.

1.8 FIELD CONDITIONS

A. Interruption of Existing Fire-Suppression Service: Do not interrupt fire-suppression service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary fire-suppression service in accordance with requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of fire-suppression service.
2. Do not proceed with interruption of fire-suppression service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Automatic wet-pipe sprinkler system.

B. Automatic dry-pipe sprinkler.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Suppression System Components, Devices, and Accessories: Listed in UL's "Fire Protection Equipment Directory" and FM Approvals' "Approval Guide."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fire-suppression system equipment, specialties, accessories, installation, and testing to comply with NFPA 13.

D. Standard-Pressure Piping System Component: Listed for 175 psig minimum working pressure.

E. Delegated Design: Engage a qualified professional engineer to design fire-suppression systems.

1. Fire Pump Flow Test:

a. Fire pump flow test flow test must be performed within previous 12 months prior to completion of design documents and hydraulic calculations.

2. Margin of Safety for Available Water Flow and Pressure: 10 percent or 10 psi, whichever is greater, including losses through water-service piping, valves, and backflow preventers.
3. Sprinkler Occupancy Hazard Classifications:
   a. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   b. General Storage Areas: Ordinary Hazard, Group 1.
   c. Laundries: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Offices, including Data Processing: Light Hazard.

4. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy:0.15 gpm/sq. ft. over 1500 sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft. area.

5. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 225 sq. ft.
   b. Storage Areas: 130 sq. ft.
   c. Mechanical Equipment Rooms: 130 sq. ft.
   d. Electrical Equipment Rooms: 130 sq. ft.

6. Total Combined Hose-Stream Demand Requirement: In accordance with NFPA 13 unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm for 60 minutes.

F. Obtain documented approval of fire-suppression system design from AHJs.

2.3 FIRE-SUPPRESSION PIPING, FITTINGS, AND APPURTENANCES

A. Steel Pipe, Fittings, and Appurtenances:

1. Schedule 40 Steel Pipe: Galvanized and black steel pipe, ASTM A53/A53M.

a. Standards:

1) UL 852.

2) FM 1630.

b. Factory-applied exterior coating.
c. Factory-applied bacterial-resistant internal coating to reduce microbiologically influenced corrosion.
d. Pipe ends may be factory or field formed to match joining method.

2. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

3. Steel Couplings: Galvanized and uncoated steel, ASTM A865/A865M, threaded.

4. Gray-Iron Threaded Fittings: Galvanized and uncoated gray-iron threaded fittings, ASME B16.4, Class 125, standard pattern.

5. Malleable- or Ductile-Iron Unions: ASME B16.3.

6. Cast-Iron Flanges: ASME B16.1, Class 125.
7. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

a. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.

1) Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
2) Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

b. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1 carbon steel unless otherwise indicated.

8. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.

a. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

9. Grooved-Joint, Steel-Pipe Appurtenances:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Gruvlok; an ASC Engineered Solution.
2) Shurjoint; a part of Aalberts Integrated Piping Systems.
3) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
4) Victaulic Company.

b. Pressure Rating: 175 psig minimum.
c. Grooved-End Fittings for Steel Piping: Painted grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
d. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SYSTEM CONTROL VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Valves: 175 psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. System Control Valve, Dry Pipe Valve:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
c. Victaulic Company.
d. Viking Group Inc.

2. Standard: UL 193.
3. Design: For vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, electrical low air pressure supervisory alarm, pressure gauges, and fill-line attachment with strainer.
5. Drip cup assembly pipe drain with check valve to main drain piping.

6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
c. Victaulic Company.
d. Viking Group Inc.

7. Standards:

a. UL 260.
b. UL 1486.

8. Design: Differential-pressure type.
9. Include quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
10. Air-Pressure Maintenance Device for Dry-Pipe Valve:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) General Air Products, Inc.

2) Potter Electric Signal Company, LLC.
3) Reliable Automatic Sprinkler Co., Inc. (The).
4) Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
5) Victaulic Company.
6) Viking Group Inc.

b. Standard: UL 260.
c. Description: Automatic device to maintain minimum air pressure in piping.
d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14 to 60 psig adjustable range, and 175 psig outlet pressure.

11. Air Compressor for Dry-Pipe Valve:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Gast Manufacturing Inc.
2) General Air Products, Inc.
3) Viking Group Inc.

b. Motor Horsepower: 5 HP
c. Power: 208 or 460 V ac, 60 Hz, poly phase.
d. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA standards. Provide ASME air receiver tank as required to meet requirements on larger systems.
e. Include filters, relief valves, coolers, automatic drains, and gauges.

2.5 DRY-SPRINKLER SYSTEM NITROGEN GENERATOR WITH PURGE/VENT

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Engineered Corrosion Solutions.
2. Potter Electric Signal Company, LLC.
3. South-Tek Systems, LLC.
4. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.

B. Description: Nitrogen generator system to serve dry sprinkler zones for piping corrosion mitigation, including system venting. System is to provide required supervisory pressure within sprinkler zone. System is to include either an integrated, oil-less air compressor, located within the nitrogen generator system package, or a separate vibration-isolation mounted air compressor, also provided by nitrogen generator manufacturer.

C. Standards:

1. FM 1035.
2. UL 508A.

D. Nitrogen Generator:

1. Wall-mounted nitrogen generator to provide minimum nitrogen purity of 98 percent to the designated sprinkler systems.

2. Power: 120 V ac.
3. Bypass mode and nitrogen-generating mode.
4. Minimum Capacity: As recommended by manufacturer.

E. Air Compressor:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
2. Motor Horsepower: Fractional.

    a. Power: 120 V ac, 60 Hz, single phase.

3. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.
4. Include filters, relief valves, coolers, automatic drains, and gauges.
5. Minimum Capacity: Match capacity of nitrogen generator.

F. Automatic Purge Vent/Valve:

1. Vents oxygen during system nitrogen fill.
2. Automatically closes when 98 percent minimum nitrogen has been reached.
3. Sized to allow correct purge rate per manufacturer's written instructions and with 14 days.
4. Provide one venting device for each dry/ preaction sprinkler system zone.
5. Include a connection port for a portable nitrogen purity sensor or a nitrogen purity manifold.

G. Supervisory Gas Monitoring - Nitrogen Purity Sensing Device:

1. Permanently Mounted Nitrogen Purity Monitoring Device or Manifold: Permanent monitoring device to continuously monitor system's nitrogen purity.

H. BAS Alarm Integration:

1. Provide nitrogen-generation system with integrated leak-detection and bypass alarms. Program alarms into controller and connect to BAS.

    a. Leak-detection system is to alarm if leaks develop within fire-suppression system piping.
    b. Air bypass alarm is to activate if nitrogen-generation system is bypassed by air compressor.

2.6 FIRE-SUPPRESSION PIPING SPECIALTIES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Shurjoint; a part of Aalberts Integrated Piping Systems.
    b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
    c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.

4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. AGF Manufacturing, Inc.
    b. Reliable Automatic Sprinkler Co., Inc. (The).
    c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
    d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. AGF Manufacturing, Inc.
    b. Croker; a Division of Morris Group International.
    c. Potter Roemer LLC; a Division of Morris Group International.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Viking Group Inc.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Aegis Technologies, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Flexhead; an ASC Engineered Solution.
    b. Gateway Tubing, Inc.
    c. Victaulic Company.

2. Standards:

    a. UL 2443.
    b. FM 1637.

3. Description: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

G. Automatic (Ball-Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Viking Group Inc.

2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

H. Automatic Air Vent:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. AGF Manufacturing, Inc.
    b. Engineered Corrosion Solutions.
    c. Metraflex Company (The).
    d. Reliable Automatic Sprinkler Co., Inc. (The).

2. Description: Automatic air vent that automatically vents trapped air without human intervention. Approved for use in wet-pipe fire-suppression system.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.7 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Reliable Automatic Sprinkler Co., Inc. (The).
2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
3. Victaulic Company.
4. Viking Group Inc.

B. Standards:

1. UL 199.
2. UL 1767.
3. UL 1626.
4. FM 2000.
5. FM 2008.
6. FM 2030.

C. Listed in UL's "Fire Protection Equipment Directory" or FM Approvals' "Approval Guide."

D. Pressure Rating for Sprinklers:

1. Standard Automatic Sprinklers: 175 psig minimum.
2. Residential Sprinklers: 175 psig maximum.

E. Sprinklers, Automatic Wet with Heat-Responsive Element:

1. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

2. Standard Spray, Quick Response:

a. Upright.
b. Pendent.
c. Recessed pendent.
d. Flat, concealed pendent.
e. Vertical sidewall.
f. Horizontal sidewall.
g. Flat, concealed horizontal sidewall.

F. Sprinklers, Automatic Dry with Heat-Responsive Element:

1. Standard Spray, Quick Response:
a. Pendent.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards and Water Shields:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Reliable Automatic Sprinkler Co., Inc. (The).
    b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
    c. Victaulic Company.
    d. Viking Group Inc.

2. Standard: UL 199.
3. Description: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Match alarm-device material and connection types to piping and equipment materials and connection types.

B. Pressure Switches - Water-Flow Alarm Detection:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Potter Electric Signal Company, LLC.
    b. System Sensor; Honeywell International, Inc.

2. Description: Electrically supervised, pressure-activated water-flow switch with retard feature.
3. Components: Two single-pole, double-throw switches with normally closed contacts.
4. Design Operation: Rising pressure to 6 psi , plus or minus 2 psi signals water flow.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch to provide for separation of wiring to each switch connection to allow for low- and high-voltage connections to comply with NFPA 70, Article 760 requirements.

C. Pressure Switches - Low/High Air Pressure Supervisory:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Potter Electric Signal Company, LLC.
    b. System Sensor; Honeywell International, Inc.

2. Description: Electrically supervised pressure supervisory switch.
3. Components: Two single-pole, double-throw switches.

4. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
5. Adjustability: Each switch is to be independently adjustable.
6. Wire Separation: Pressure switch to provide for separation of wiring to each switch connection to allow for low- and high-voltage connections to comply with NFPA 70, Article 760 requirements.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Kennedy Valve Company; a division of McWane, Inc.
    b. Potter Electric Signal Company, LLC.
    c. System Sensor; Honeywell International, Inc.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Design: Signals that controlled valve is in other than fully open position.
5. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on valve and valve is fully open.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
7. OS&Y Valve Supervisory Switches:

    a. One or two single-pole, double-throw switches.
    b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
    c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
    d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
    e. Trip Rod Length: Adjustable

8. Butterfly Valve Supervisory Switches:

    a. Two single-pole, double-throw switches.
    b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
    c. Mounting Hardware: Removable nipple.
    d. Trip Rod Length: Adjustable

9. Ball Valve Supervisory Switches:

    a. One single-pole, double-throw switch.
    b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
    c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves, or backflow preventers sized from up to NPS 2.

2.9 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Ametek U.S. Gauge.
2. Ashcroft Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0 to 300 psig.

E. Water System Piping Gauge: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire pump flow test. Per NFPA 25 Use results for system design calculations required in "Quality Assurance" Article.

B. Water Supply Curve: Provide water supply curve based on the lowest supply for a given set of test data. For a given residual pressure reading, the supply is to be graphed utilizing the corresponding pitot pressure/flow reading and static pressure reading.

C. Documentation is to include calibration certifications for gauges used in the flow tests. The certifications are to be from within the previous six (6) months from a reputable agency recognized for certifying pressure gauges.

D. Report flow test results promptly and in writing. A copy of the flow test data report is to be submitted with the hydraulic calculations.

3.2 INSTALLATION OF FIRE-SUPPRESSION PIPING

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from AHJs. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of fire-suppression piping.

C. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install inspector's test connections in sprinkler system piping, complete with shutoff valve, and sized and located in accordance with NFPA 13.

G. Install fire-suppression system piping with drains for complete system drainage. Extend drain piping to exterior of building where possible.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire department connection, to drain piping between fire department connection and check valve. Install drain piping to and spill over floor drain or to exterior of building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for fire-suppression piping in accordance with NFPA standards. Comply with requirements for hanger materials in NFPA standards**.**

L. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices air compressors.

M. Fill wet-type fire-suppression system piping with water.

N. Drain dry-type fire-suppression system piping.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210500 "Common Work Results for Fire-Suppression Piping."

3.3 INSTALLATION OF PIPING JOINTS

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators in accordance with "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

3.4 INSTALLATION OF VALVES AND SPECIALTIES

A. Install listed fire-suppression system control valves, trim and drain valves, specialty valves and trim, controls, and specialties in accordance with manufacturer's installation instructions, NFPA standards, and AHJ.

B. Install listed fire-suppression system shutoff valves in supervised open position, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. System Control Valves:

1. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
2. Install dry-pipe and preaction valves with trim sets for air supply, drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
    a. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14 to 60 psig adjustable range; and 175 psig maximum inlet pressure.

3. Install deluge valves with trim sets for drain, priming level, alarm connections, ball-drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

D. Air Vent:

1. Provide at least one air vent at high point in each wet-pipe fire-suppression system in accordance with NFPA standards. Connect vent into top of fire-suppression piping.
2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3.5 INSTALLATION OF SPRINKLERS

A. Install sprinklers in suspended ceilings symmetrically in center of acoustical ceiling panels within tolerance of 1/2 inch. Coordinate entire pattern of sprinkler locations with approved reflected ceiling plan.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.6 INSTALLATION OF NITROGEN GENERATOR WITH PURGE/VENT SYSTEM

A. Install in accordance with manufacturer's written installation instructions.

B. Locate purge vent/valve in accordance with manufacturer's written installation instructions.

C. Route alarm signals in code-approved electrical conduit from nitrogen generator system control panel to the supervisory circuit of BAS.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping in accordance with requirements for identification specified in Section 210553 "Identification for Fire-Suppression Piping and Equipment."

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Perform the following tests and inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect fire-suppression systems in accordance with NFPA standards.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Verify that sprinklers original factory finish has not been contaminated with dirt, debris, or paint. Sprinklers containing other-than-original factory finish are to be considered defective and replaced with new products. Repair and/or cleaning is not acceptable.

C. Fire-suppression piping system will be considered defective if it does not pass tests and inspections.

D. Fire-suppression piping system components considered defective during testing will be replaced with new components. Repair of defective components is not acceptable.

E. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from fire-suppression system piping, system control valves, sprinklers, and associated components.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain system control valves.

3.11 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 and Smaller, to Be the Following:

1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 8, to Be the Following:

2. Schedule 40, black-steel pipe with roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, semi – recessed sprinklers as indicated.
3. Wall Mounting: Horizontal sidewall sprinklers as indicated.
4. Spaces Subject to Freezing: Dry pendent sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces and locations not generally exposed to view; and wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211000

SECTION 213413

PRESSURE-MAINTENANCE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Regenerative-turbine, pressure-maintenance pumps.

B. Related Requirements:

1. Section 262933 "Controllers for Fire-Pump Drivers" for pressure-maintenance-pump controllers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pumps, accessories, and specialties.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 REGENERATIVE-TURBINE, PRESSURE-MAINTENANCE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-C Fire Pump; a Xylem brand.
2. Aurora Pump; Pentair Ltd.
3. MTH Pumps/MTH Tool Company, Inc.

4. PACO Pumps; Grundfos Pumps Corporation, USA.

B. Description: Factory-assembled and -tested, close-coupled, single-stage, regenerative-turbine centrifugal pump as defined in HI 1.1-1.2 and HI 1.3; with pump and motor mounted horizontally.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded inlet and outlet.
2. Impeller: Bronze, balanced, and keyed to shaft.
3. Pump Shaft: Stainless steel with deflector.
4. Shaft Sleeve: Bronze.
5. Seal: Mechanical type with spring-loaded rotating head.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Section 210500 "Common Work Results for Fire Suppression."

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

G. Capacities and Characteristics: - To match existing pump being replaced.

H. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 210500 "Common Work Results for Fire Suppression."

1. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Equipment Mounting:

1. Install multistage and regenerative-turbine, pressure-maintenance pumps according to HI 1.4.
2. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
   a. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   b. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   c. Install anchor bolts to elevations required for proper attachment to supported equipment.
   d. Attach pumps to equipment base using anchor bolts.
   e. Shim pumps as needed to make them level.

3. Install isolation valves in both inlet and outlet pipes near the pump. Comply with requirements for valves specified in Section 211000 "Water-Based Fire-Suppression Systems."

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Lubricate pumps as recommended by manufacturer.

B. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION 213413

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include material descriptions and dimensions of individual components.
b. Include operating characteristics and furnished accessories.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooved ends, press ends, solder ends, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic-water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Type:
1. Hand Lever: For quarter-turn ball valves smaller than NPS 4.

G. Valves in Insulated Piping:

1. Provide 2-inch extended neck stems.
2. Provide extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Provide memory stops that are fully adjustable after insulation is applied.

2.3 BALL VALVES, LEAD FREE

A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.Y. McDonald Mfg. Co.
b. American Valve, Inc.
c. Apollo Valves; a part of Aalberts Integrated Piping Systems.
2. Standards: MSS SP-110 and MSS SP-145.
3. CWP Rating: 600 psig .
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Threaded or soldered..
7. Seats: PTFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.

B. Ball Valves, Lead Free, Press Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Valve, Inc.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. Crane Fluid Systems; Crane Co.
2. Standards: MSS SP-110, MSS SP-145, IAPMO/ANSI Z1157.
3. CWP Rating: Minimum 200 psig .
4. Body Design: Two piece.
5. Body Material: Forged brass.
6. Ends: Press.
7. Press-End Connections Rating: Minimum 200 psig .
8. Seats: PTFE or RPTFE.
9. Stem: Brass.
10. Ball: Chrome-plated brass.
11. Port: Full.
12. O-Ring Seal: NBR or EPDM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Examine press fittings to verify they have been properly pressed.

F. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position to allow full stem and actuator or manual operator movement.

F. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

G. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

H. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's written recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

3.5 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
1. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and brass trim; threaded or soldered ends.

END OF SECTION 220523

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.2 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: G90 Hot-dip galvanized.
8. Paint Coating: Green epoxy, acrylic, or urethane.

2.5 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated or stainless steel.
   2. Outdoor Applications: Stainless steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Framing System Installation: Metal; arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

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1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. MSS SP-58, Type 39: Install protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. MSS SP-58, Type 40: Install protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup:

1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

    a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use thermal hanger-shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
   3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   4. .

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

   1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. C-Clamps (MSS Type 23): For structural shapes.
   6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   8. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
   9. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Champion America.
d. Pipemarker.com; Brimar Industries, Inc.
e. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Champion America.
4. Pipemarker.com; Brimar Industries, Inc.
5. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Champion America.
4. Pipemarker.com; Brimar Industries, Inc.
5. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows onmain distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping] [At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Carlton Industries, LP.
3. Champion America.
4. Pipemarker.com; Brimar Industries, Inc.
5. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.04-inchminimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire link chain.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.

1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where are-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E**,** and other applicable codes and standards.

3.4 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft**.** along each run. Reduce intervals to 10 ft**.** in areas of congested piping and equipment.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:
1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
2. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background
3. Domestic Hot-Water Return Piping White letters on an ANSI Z535.1 safety-green background.
4. Sanitary Waste Piping: White letters on a black background.

3.5 INSTALLATION OF VALVE TAGS

A. .

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Domestic Cold Water: 1-1/2 inches round.
b. Domestic Hot Water: 1-1/2 inches round.
c. Domestic Hot-Water Return: 1-1/2 inches, round.

2. Valve-Tag Colors:

a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

END OF SECTION 220553

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation" for equipment insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. Knauf Insulation.
    c. Manson Insulation Inc.
    d. Owens Corning.
2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ramco Insulation, Inc.

B. Glass-Fiber and Mineral Wool Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ramco Insulation, Inc.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.

C. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Mon-Eco Industries, Inc.

2.4 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Knauf Insulation.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range:Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Knauf Insulation.

2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range:Minus 20 to plus 180 deg F.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg **F** .
4. Color: White.

2.6 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ideal Tape Co., Inc., an American Biltrite Company.
   b. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 11.5 mils>.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Ideal Tape Co., Inc., an American Biltrite Company.
   b. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.9 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inc wide with wing seal].
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch] wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel].

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire Products.
b. Johns Manville; a Berkshire Hathaway company.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGuire Manufacturing.
b. Plumberex Specialty Products, Inc.
c. Truebro; IPS Corporation.
d. Zurn Industries, LLC.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; IPS Corporation.
b. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents**.**

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches . Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch , and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers ,two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation is the following:
   a. .
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation is the following:
   a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation is the following:

a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings - domestic water.
2. Dielectric fittings - domestic water.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372.

2.2 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Drawn-Temper Copper Tube: [ASTM B88, Type L

B. Annealed-Temper Copper Tube: ASTM B88, Type L

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

F. Pressure-Seal-Joint Fittings, Copper or Bronze - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Mueller Streamline Co.; a company of Mueller Industries.
c. Viega LLC.

2. Source Limitations: Obtain pressure-seal-joint fittings, copper or bronze, from single manufacturer.
3. Housing: Copper.
4. O-Rings and Pipe Stops: EPDM.
5. Minimum 200 psig working-pressure rating at 250 deg F.

G. Copper-Tube, Push-on-Joint Fittings - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems.
c. NIBCO INC.

2. Source Limitations: Obtain copper-tube, push-on-joint fittings from single manufacturer.
3. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.

2.3 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Solder Filler Metals: ASTM B32, lead-free alloys.

B. Flux: ASTM B813, water flushable.

C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS - DOMESTIC WATER

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A.Y. McDonald Mfg. Co.
b. WATTS; A Watts Water Technologies Company.
c. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Matco-Norca.
c. WATTS; A Watts Water Technologies Company.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install valves in accordance with Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

E. Install domestic water piping level and plumb.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220500 "Common Work Results for Plumbing."

O. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123.21 "Inline, Domestic Water Pumps."

P. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220500 "Common Work Results for Plumbing."

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

3.3 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Install hangers for copper, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 ADJUSTING

A. Perform the following adjustments before operation:

   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      b. Adjust calibrated balancing valves to flows indicated.

   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Hydrostatic testing and documentation of test results for polypropylene (PP-R and PP-RCT) pipe to be in accordance with manufacturer's written instructions and submitted to manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221116

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers for domestic water piping.
7. Drain valves.
8. Water-hammer arresters.
9. Trap-seal primer device.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.

2.4 BACKFLOW PREVENTERS

A. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2].
5. Body: Bronze with union inlet.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Cash Acme Plumbing Products; an RWC brand.
    c. WATTS; A Watts Water Technologies Company.
    d. Zurn Industries, LLC.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; bronze cast iron with interior lining that complies with AWWA C550 or that is FDA approved] for NPS 2-1/2 and NPS 3.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Bell & Gossett; a Xylem brand.
    b. Nexus Valve, Inc.; Aalberts Hydronic Flow Control.
    c. WATTS; A Watts Water Technologies Company.

2. Type: Ball] valve with two readout ports and memory-setting indicator.
3. Body:Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
6. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lawler Manufacturing Company, Inc.
    b. POWERS; A Watts Water Technologies Company.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Connections: Threaded inlets and outlet.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Titan Flow Control, Inc.
    b. WATTS; A Watts Water Technologies Company.
    c. Zurn Industries, LLC.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.033 inch

7. Drain: Factory-installed, hose-end drain valve.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Sioux Chief Manufacturing Company, Inc.
    b. WATTS; A Watts Water Technologies Company.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Precision Plumbing Products.
b. Sioux Chief Manufacturing Company, Inc.
c. WATTS; A Watts Water Technologies Company.
d. Zurn Industries, LLC.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Precision Plumbing Products.
b. Zurn Industries, LLC.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

F. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

G. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

END OF SECTION 221119

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Copper tube and fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 FIELD CONDITIONS

1. Notify Owner of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings:
1. ASTM A74, extra-heavy cast iron.

B. Gaskets: ASTM C564, rubber.

C. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of the McWane family of companies.

B. Pipe and Fittings:
1. ASTM A888 or CISPI 301.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Charlotte Pipe and Foundry Company.
2. Standards: ASTM C1277 and ASTM C1540. .
3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2.5 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Unshielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Dallas Specialty & Mfg. Co.
      2) Fernco Inc.
      3) Mission Rubber Company, LLC.

   b. Standard: ASTM C1173.
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. End Connections: Same size as and compatible with pipes to be joined.
   e. Sleeve Materials:

      1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
      2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926 PVC.
      3) For Dissimilar Pipes: ASTM D5926 PVC or other material compatible with pipe materials being joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

J. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."

N. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

2. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Join copper tube and fittings with soldered joints in accordance with ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.

3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment"

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42 clamps.
4. Install individual, straight, horizontal piping runs:

a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch.
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; [
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
4. couplings.

B. Aboveground, vent piping NPS 4 (DN 100) is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.

3. Copper Type DWV tube, copper drainage fittings, and soldered joints.

C. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:

1. Extra-heavy cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Cleanouts.
2. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS; A Watts Water Technologies Company.
    e. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS; A Watts Water Technologies Company.
    e. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket
9. Adjustable Housing Material: Cast iron > with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Heavy Duty.
13. Riser: ASTM A74, Extra-Heavy Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. WATTS; A Watts Water Technologies Company.
    d. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

a. Cast iron.
b. Countersunkhead.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, wall-installation frame and cover.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Floor-Drain, Inline Trap Seal:
1. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
2. Material: Polymer.
3. Standard: Tested and certified in accordance with ASSE 1072.
4. Size: Same as floor drain outlet or strainer throat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

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D. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

E. .

F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

G. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224200

COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial lavatories.
2. Commercial showers.
3. Commercial sinks.
4. Commercial urinals.
5. Commercial water closets.
6. Flushometer valves.
7. Toilet seats.
8. Fixture carriers.

1.2 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PMMA: Polymethyl methacrylate; also known as "acrylic."

C. Standard-Efficiency Flush Volume: 1.6 gal. per flush.

D. High-Efficiency Flush Volume: 1.28 gal. or less per flush.

E. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Plans, elevations, sections, and mounting details.
2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories and/or counter-mounted sinks.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For lavatories and faucets.

1) Servicing and adjustments of automatic faucets.

2. For shower valves to include in maintenance manuals
3. For sinks and faucets to include in operation and maintenance manuals.

a. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1) Servicing and adjustments of automatic faucets.

4. For flushometer valves and electronic sensors to include in operation and maintenance manuals.
5. For wash fountains and components to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lavatory faucets, sink faucets, shower valves, and faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COMMERCIAL LAVATORIES

A. Lavatories, Counter Mounted:

1. Lavatories, Undercounter Mounted – acrylic-polyester, Oval:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) American Standard.
2) Kohler Co.
3) TOTO USA, INC.
4) Zurn Industries, LLC.
5) Crane
6) Elkay
7) Just
8) Advance Tabco
9) Frank

10) Corian Design

b. Fixture:

1) Standard: ASME A112.19.2/CSA B45.1.
2) Type: For undercounter mounting.
3) Nominal Size: Oval, 16-1/8 by 13.
4) Faucet-Hole Punching: No holes.
5) Faucet-Hole Location: On countertop.
6) Color: White.
7) Mounting Material: Sealant and undercounter mounting kit.

c. Faucet: "Lavatory Faucets, Automatically Operated".

2. Lavatories, Wall Mounted - Vitreous China, Rectangular with Back:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) American Standard.
2) Kohler Co.
3) Zurn Industries, LLC.
4) Crane
5) Elkay
6) Just
7) Toto
8) Advance Tabco
9) Frank
10) Corian Design

b. Fixture:

1) Standard: ASME A112.19.2/CSA B45.1.
2) Type: For wall hanging.
3) Nominal Size: Rectangular, 20 by 18 inches.
4) Faucet-Hole Punching: Three holes, 4-inch centers.
5) Faucet-Hole Location: Top.
6) Color: White.
7) Mounting Material: Chair carrier.

c. Faucet: "Lavatory Faucets, Automatically Operated".
d. Support: Lavatory carrier, floor affixed with steel uprights.
e. Lavatory Mounting Height: Standard

B. Lavatory Faucets, Automatically Operated:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. American Standard.
b. Bradley Corporation.
c. Chicago Faucets; Geberit Group.
d. Delta Faucet Company.
e. Elkay.
f. Just Manufacturing.

g. Kohler Co.
h. Zurn

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Operation Type: Battery powered electronic sensor operated, mixing.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
5. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

6. Body Type: Single hole.
7. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
8. Finish: Polished chrome plate.
9. Maximum Flow Rate: 0.5 gpm.
10. Mounting Type: Deck.
11. Spout: Rigid type.

C. Lavatory Supply Fittings:

1. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.
3. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

D. Lavatory Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
3. Trap:

a. Size: NPS 1-1/2.

2.3 COMMERCIAL SHOWERS

A. Showers, Individual:

1. Showers, Individual - PMMA :
a. Source Limitations: Obtain PMMA showers from single source from single manufacturer.
b. Description: PMMA shower enclosure with valve and receptor and appurtenances.
c. Type: One-piece].
d. Standard: CSA B45.5/IAPMO Z124.
e. Style: Standard.
f. Shower Nominal Size and Shape: 36 by 36 inches square]
g. Color: White.
h. Outlet: Drain with NPS 2 outlet.
i. Shower Rod and Curtain: Required.
j. Grab Bar: Not required.

B. Shower Valve Assemblies:

1. Shower Valve Assemblies - Single-Handle, Thermostatic/Pressure-Balancing Mixing Valve with Head:
   a. Source Limitations: Obtain shower heads and shower valves from single source from single manufacturer.
   b. Description: Single-handle, thermostatic/pressure-balancing mixing valve with hot- and cold-water indicators;
   c. Shower Valve:

      1) Standards:

         a) ASME A112.18.1/CSA B125.1.
         b) ASSE 1016/ASME A112.1016/CSA B125.16.

      2) Body Material: Solid brass.
      3) Finish: Polished chrome plate.
      4) Operation: Single-handle, twist or rotate control.
      5) Antiscald Device: Integral with mixing valve.
      6) Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

   d. Supply Connections: NPS 1/2.
   e. Shower Head:

      1) Standard: ASME A112.18.1/CSA B125.1.
      2) Shower Head Maximum Flow Rate: 1.5 gpm.
      3) Shower Head Material: Metallic with chrome-plated finish.
      4) Spray Pattern: Fixed.
   f. [

2.4 COMMERCIAL SINKS

A. Kitchen/Utility Sinks:

1. Kitchen/Utility Sinks, Counter Mounted – Acrylic-polyester:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Advance Tabco.
      2) Elkay.
      3) Just Manufacturing.
      4) American Standard
      5) Kohler
      6) Zurn
      7) Crane
      8) Toto
      9) Frank
      10) Corian Design
   b. Source Limitations: Obtain sinks from single source from single manufacturer.
   c. Fixture:

      1) Standard: ASME A112.19.3/CSA B45.4.

2) Number of Compartments: One.
3) Overall Dimensions: 27 x 16 x 5-1/2 inch.
4) Material: acrylic-polyester.

5) Compartment:
   a) Drain: NPS 1-1/2 tailpiece >.
   b) Drain Location: Centered in compartment

d. Faucet(s):

1) Number Required: One.
2) Mounting: On ledge.

e. Supply Fittings:

1) Standard: ASME A112.18.1/CSA B125.1.
2) Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

f. Waste Fittings:

1) Standard: ASME A112.18.2/CSA B125.2.
2) Trap(s) Size: NPS 2.

2. Sink Faucets, Manually Operated [Two handle, mixing.
   a. Source Limitations: Obtain sink faucets from single source from single manufacturer.
   b. Standards:

1) ASME A112.18.1/CSA B125.1.
2) NSF 61.
3) NSF 372.

c. Description: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
d. Body Type: Widespread.
e. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
f. Finish: Chrome plated.

g. Maximum Flow Rate: 1.5 gpm.
h. Mounting Type: Deck, exposed.
i. Valve Handle(s): 4-inch wrist blade
j. Spout Type: Swivel, gooseneck.
k. Spout Outlet: Aerator
l. Pre-Rinse Unit:

B. .Sink Supply Fittings:

1. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
2. Standard: ASME A112.18.1/CSA B125.1.

3. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.
4. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

C. Sink Waste Fittings:

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
3. Trap:

a. Size: NPS 1-1/2.

2.5 COMMERCIAL URINALS

A. Urinals, Wall Hung:

1. Urinals, Wall Hung - Back Outlet, Washdown:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Sloan Valve Company.

2) America Standard

3) Kohler

4) Zurn

5) Crane

6) Elkay

7) Just

8) Toto

9) Advance Tabco

10) Frank

11) Corian Design

b. Fixture:

1) Standards:

a) ASME A112.19.2/CSA B45.1.
b) ASME A112.19.5/CSA B45.15.

2) Material: Vitreous china.
3) Type: Washdown with extended shields.

4) Strainer or Trapway: Manufacturer's standard strainer with integral trap.

5) Water Consumption: 0.5 gpf.
6) Spud Size and Location: NPS 3/4, top.
7) Outlet Size and Location: NPS 2, back.
8) Color: White.

c. Flushometer Valve: Exposed, chrome-plated, battery powered>.
d. Waste Fitting:

1) Standard: ASME A112.18.2/CSA B125.2 for coupling.
2) Size: NPS 2.

e. Support: Urinal carrier, floor affixed with steel uprights with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
f. Urinal Mounting Height: Standard].

2.6 COMMERCIAL WATER CLOSETS

A. Water Closets, Wall Mounted:

1. Water Closets, Wall Mounted - Top Spud:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) American Standard.
2) Kohler Co.
3) Sloan Valve Company.
4) TOTO USA, INC.
5) Zurn Industries, LLC.
6) Crane
7) Elkay
8) Just
9) Advance Tabco
10) Frank
11) Corian Design

b. Source Limitations: Obtain water closets from single source from single manufacturer.
c. Standard: ASME A112.19.2/CSA B45.1.
d. Bowl:

1) Material: Vitreous china.
2) Type: Siphon jet.
3) Style: Flushometer valve.
4) Mounting Height: Standard
5) Rim Contour: Elongated.
6) Water Consumption: 1.28 gal. per flush.
7) Spud Size and Location: NPS 1-1/2; top.
8) Color: White.

e. Support: Water-closet carrier, floor affixed.

f.

2.7 FLUSHOMETER VALVES

A. Flushometer Valves, Sensor Operated:

1. Flushometer Valves, Sensor Operated - Diaphragm:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Delany Products.
2) Sloan Valve Company.
3) Zurn Industries, LLC.
4) Toto

b. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
c. Standard: ASSE 1037/ASME 112.1037/CSA B125.37.
d. Minimum Pressure Rating: 125 psig.
e. Features: Include integral check stop and backflow-prevention device.
f. Material: Brass body with corrosion-resistant components.
g. Style: Exposed.
h. Exposed Flushometer-Valve Finish: Chrome-plated.
i. Actuator: Side or top mounted; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.
j. Trip Mechanism: Battery-powered electronic sensor; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and application.
k. Consumption: 1.28 gal. per flush.
l. Minimum Inlet: NPS 3/4.
m. Minimum Outlet: NPS 1-1/4.

2.8 TOILET SEATS

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A. Toilet Seats>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bemis Manufacturing Company.
b. Church Seats; Bemis Manufacturing Company.
c. Sperzel
d. Beneke
e. Olsonite

2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
3. Standard: IAPMO/ANSI Z124.5.
4. Material: Plastic.
5. Type: Commercial (Heavy duty).
6. Shape: Elongated rim, open front.
7. Hinge: Check.
8. Hinge Material: Noncorroding metal.

9. Color: White.
10.

2.9 FIXTURE CARRIERS

A. Fixture Carriers - Lavatory:

1.
2. Source Limitations: Obtain lavatory carriers from single source from single manufacturer.
3. Standards:

a. ASME A112.6.1M.
b. ASME A112.6.2.

B. Fixture Carriers - Sink:
1. Source Limitations: Obtain sink carriers from single source from single manufacturer.
2. Standards:

a. ASME A112.6.1M.
b. ASME A112.6.2.

C. Fixture Carriers - Urinal:
1. Source Limitations: Obtain urinal carriers from single source from single manufacturer.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture

D. Fixture Carriers - Water Closet:
1. Source Limitations: Obtain water closet carriers from single source from single manufacturer.
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings, gaskets, and feet; bolts and hardware matching fixture

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine walls and floors for suitable conditions where plumbing fixtures will be installed.

C. Examine counters for suitable conditions where lavatories and sinks will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COMMERCIAL PLUMBING FIXTURES

A. Lavatory Installation:

1. Install lavatories level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible, wall-mounted lavatories at mounting height in accordance with ICC A117.1.
4. Install water-supply piping with stop on each supply to each lavatory faucet. Install stops in locations that are accessible for ease of operation.
5. Install trap and waste piping on each drain outlet of each lavatory to be connected to sanitary drainage system.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
8. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

B. Shower Installation:

1. Assemble shower components in accordance with manufacturers' written instructions.
2. Install showers level and plumb in accordance with roughing-in drawings.
3. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with ball valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping." Install valves in locations that are accessible for ease of operation.
4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Set shower receptors] in leveling bed of cement grout.
6. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
7. Seal joints between showers, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

C. Sink Installation:

1. Install sinks level and plumb in accordance with roughing-in drawings.
2. Install supports, affixed to building substrate, for wall-mounted sinks.
3. Install accessible, wall-mounted sinks at mounting height in accordance with ICC A117.1.
4. Set floor-mounted sinks in leveling bed of cement grout.
5. Install water-supply piping with stop on each supply to each sink faucet.

    a. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General Duty Valves for Plumbing Piping."
    b. Install stops/valves in locations that are accessible for ease of operation.

6. Install trap and waste piping on each drain outlet of each sink to be connected to sanitary drainage system.

7. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
8. Seal joints between sinks, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
9. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

D. Urinal Installation:

1. Install urinals level and plumb in accordance with roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste-fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height in accordance with ICC A117.1.
5. Install supports, affixed to building substrate, for wall-hung urinals.
6. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
7. Use carriers without waste fitting for urinals with tubular waste piping.
8. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
9. Measure support height installation from finished floor, not structural floor.
10. Install flushometer-valve, water-supply fitting on each supply to each urinal.
11. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
12. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
13. Install actuators in locations easily reachable for people with disabilities.
14. Install new batteries in battery-powered, electronic-sensor mechanisms.
15. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
16. Seal joints between urinals, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to urinal color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

E. Water Closet Installation:

1. Install water closets level and plumb in accordance with roughing-in drawings.
2. .
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.
4. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
5. Use carrier supports with waste-fitting assembly and seal.
6. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals, and affix to building substrate.
7. Measure support height installation from finished floor, not structural floor.
8. Install flushometer-valve, water-supply fitting on each supply to each water closet.
9. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
10. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
11. Install actuators in locations easily reachable for people with disabilities.
12. Install new batteries in battery-powered, electronic-sensor mechanisms.
13. Install toilet seats on water closets.

14. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Install deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
15. Seal joints between water closets, walls, and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to water-closet color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 INSTALLATION OF PIPING CONNECTIONS

A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil, waste, and vent piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible plumbing fixtures. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

E. Where installing piping adjacent to water closets and urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning plumbing fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Adjust water pressure at shower valves to produce proper flow.

D. Adjust water pressure at flushometer valves to produce proper flow.

E. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damages finishes. Replace any fixtures unable to be repaired to the satisfaction of the [Architect] [Owner].

B. Clean plumbing fixtures and associated faucets, valves, flushometer valves, and fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and associated faucets, valves, flushometer valves, and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motors.
2. Sleeves without waterstop.
3. Sleeves with waterstop.
4. Sleeve-seal systems.
5. Grout.
6. Escutcheons.

1.2 DEFINITIONS

A. Existing Piping To Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of HVAC equipment Sections.

a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
b. Include operating characteristics and furnished accessories.

1.4 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 MOTORS

A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. (1000 m) above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
3. Multispeed Motors: Variable torque.
    a. For motors with 2:1 speed ratio, consequent pole, single winding.
    b. For motors with other than 2:1 speed ratio, separate winding for each speed.
4. Multispeed Motors, Two Winding: Separate winding for each speed.
5. Rotor: Random-wound, squirrel cage.
6. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
7. Temperature Rise: Match insulation rating.
8. Insulation: Class F.
9. Code Letter Designation:
    a. Motors 15 Hp and Larger: NEMA starting Code F or Code G.
    b. Motors Smaller Than 15 Hp: Manufacturer's standard starting characteristic.

D. Additional Requirements for Polyphase Motors:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
    a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
    b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
    c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
    d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

E. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:

    a. Permanent-split capacitor.
    b. Split phase.
    c. Capacitor start, inductor run.
    d. Capacitor start, capacitor run.

2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 hp and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:

1. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Circuit board or digital speed controller/LED display.
4. Building Automation System Interface: Via AC voltage signal, DC voltage signal or Digital Serial Interface (DSI).

2.2 SLEEVES AND SLEEVE SEALS

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653/A653M, 24 gauge (0.6 mm) minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

B. Sleeves with Waterstop:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, LLC.
    b. CALPICO, Inc.
    c. GPT; a division of EnPRO Industries.
    d. Metraflex Company (The).

2. Description: Manufactured galvanized-steel, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.

C. Stack-Sleeve Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Wade; a subsidiary of McWane Inc.
c. Zurn Industries, LLC.

2. Description: Manufactured, galvanized cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with setscrews.

D. Sleeve-Seal Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, LLC.
b. CALPICO, Inc.
c. GPT; a division of EnPRO Industries.
d. Metraflex Company (The).

2. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

a. Hydrostatic seal: 20 psig (137 kPa) minimum).
b. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
c. Pressure Plates: Stainless steel.
d. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

E. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

2.3 ESCUTCHEONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. ProFlo; a Ferguson Enterprises, Inc. brand.

B. Escutcheon Types:

1. One-Piece, Steel Type: With polished brass finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished brass finish and setscrew fastener.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

3. Using grout, seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout, seal space around outside of sleeves.

3.3 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 3 inches (76 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.5 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.6 FIELD QUALITY CONTROL

A. Sleeves and Sleeve Seals:

1. Perform the following tests and inspections:

   a. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
   b. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.7 SLEEVES APPLICATION

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. Sleeves with waterstops.

4. Interior Walls and Partitions:

a. Sleeves without waterstops.

3.8 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, cast brass with polished, chrome-plated finish.
3. Insulated Piping:

a. One piece, steel with polished brass finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

a. One piece, steel with polished brass finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

a. One piece, steel with polished brass finish.

6. Bare Piping in Unfinished Service Spaces:

a. One piece, steel with polished, chrome-plated finish.

7. Bare Piping in Equipment Rooms:

a. One piece, steel with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

END OF SECTION

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Craftmark Pipe Markers.
c. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, with predrilled or stamped holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Craftmark Pipe Markers.
c. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, with predrilled holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlton Industries, LP.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.3 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlton Industries, LP.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:

1. Duct size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution ducts. Arrows may be either integral with label or may be applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.4 STENCILS

A. Stencils for Piping:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Craftmark Pipe Markers.
    b. Kolbi Pipe Marker Co.
    c. Marking Services Inc.
    d. Pipemarker.com; Brimar Industries, Inc.

2. Lettering Size: Size letters in accordance with ASME A13.1 for piping.
3. Stencil Material: Aluminum, brass, or fiberboard.
4. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

B. Stencils for Ducts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Craftmark Pipe Markers.
b. Kolbi Pipe Marker Co.
c. Marking Services Inc.
d. Pipemarker.com; Brimar Industries, Inc.

2. Lettering Size: Minimum letter height of 1-1/4 inches (32 mm) for viewing distances of up to 15 ft. (4-1/2 m) and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: Color as indicated for specific application under Part 3.

C. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Craftmark Pipe Markers.
b. Kolbi Pipe Marker Co.
c. Marking Services Inc.
d. Pipemarker.com; Brimar Industries, Inc.

2. Lettering Size: Minimum letter height of 1/2 inch (13 mm) for viewing distances of up to 72 inches (1830 mm) and proportionately larger lettering for greater viewing distances.
3. Stencil Material: Fiberboard or metal.
4. Stencil Paint: Exterior, gloss, alkyd enamel. Paint may be in pressurized spray-can form.
5. Identification Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
6. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Sign and Label Colors:

1. White letters on an ANSI Z535.1 safety-blue background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

3.4 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

C. Stenciled Pipe Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Within 3 ft. (1 m) of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. (1 m) of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. (8 m) along each run. Reduce intervals to 10 ft. (3.0 m) in areas of congested piping, ductwork, and equipment.

E. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

F. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

G. Pipe-Label Color Schedule:

1. Refrigerant Piping: White letters on an ANSI Z535.1 safety-blue background.

3.5 INSTALLATION OF DUCT LABELS

A. Install self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.

1. Provide labels in the following color codes:

    a. For air supply ducts: White letters on blue background.
    b. For air return ducts: White letters on blue background.

B. Stenciled Duct-Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

1. For all air ducts: Black letters on white background.

C. Locate label near each point where ducts enter into and exit from concealed spaces and at maximum intervals of 20 ft. (6 m) where exposed or are concealed by removable ceiling system.

D. Stenciled Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Black letters on White background.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

a. Constant-volume and single zone air systems.

2. Testing, adjusting, and balancing of equipment.

1.3 DEFINITIONS

Retain definition(s) remaining after this Section has been edited.

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

G. UFAD: Underfloor air distribution.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

C. Certified TAB reports.

D. Sample report forms.

E. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.6 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

N. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.

d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Air curtains.
3. Rooftop air-conditioning units.
4. Split-system air conditioners.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME OR SINGLE ZONE AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR AIR-COOLED CONDENSERS

A. Verify proper rotation of fan(s).

B. Measure and record entering- and leaving-air temperatures.

C. Measure and record entering and leaving refrigerant pressures.

D. Measure and record operating data of fan(s) and motor(s).

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Air pressure drop.
5. Voltage and amperage input of each phase at full load.
6. Calculated kilowatt at full load.
7. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

4. Air pressure drop.
5. Entering and leaving refrigerant pressure and temperatures.

3.10 HVAC CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify HVAC control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.11 TOLERANCES

A. Set HVAC system's airflow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent. If design value is less than 100 cfm (47 L/s), within 10 cfm (4.7 L/s).
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm (47 L/s), within 10 cfm (4.7 L/s).

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Heating coil, dry-bulb conditions.
    e. Face and bypass damper settings at coils.
    f. Fan drive settings, including settings and percentage of maximum pitch diameter.
    g. Variable-frequency controller settings for variable-air-volume systems.
    h. Settings for pressure controller(s).
    i. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
    j. Number, make, and size of belts.

k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan speed.
d. Inlet and discharge static pressure in inches wg (Pa).
e. For each filter bank, filter static-pressure differential in inches wg (Pa).
f. Preheat-coil static-pressure differential in inches wg (Pa).
g. Cooling-coil static-pressure differential in inches wg (Pa).
h. Heating-coil static-pressure differential in inches wg (Pa).
i. List for each internal component with pressure-drop, static-pressure differential in inches wg (Pa).
j. Outdoor airflow in cfm (L/s).
k. Return airflow in cfm (L/s).
l. Outdoor-air damper position.
m. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig (kPa).
j. Refrigerant suction temperature in deg F (deg C).

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm (L/s).
i. Face area in sq. ft. (sq. m).
j. Minimum face velocity in fpm (m/s).

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan speed.
d. Discharge static pressure in inches wg (Pa).

e. Suction static pressure in inches wg (Pa).

I. Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

J. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager.

B. Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.

2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

END OF SECTION 230593

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Outdoor, concealed supply, exhaust, and return.
4. Outdoor, exposed supply, exhaust and return.

B. Related Requirements:

1. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.4 COORDINATION

A. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F (232 deg C) in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

G. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F (1.7 deg C) and 250 deg F (121 deg C) for jacketed and between 35 deg F (1.7 deg C) and 450 deg F (232 deg C) for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.

b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller.

2.4 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Knauf Insulation.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and are compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Eagle Bridges - Marathon Industries.
    c. Foster Brand; H. B. Fuller.
    d. Mon-Eco Industries, Inc.

2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick polysurlyn.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Aluminum: ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.
      4) Nelson Stud Welding.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.
      4) Nelson Stud Welding.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) AGM Industries, Inc.
      2) Gemco.
      3) Midwest Fasteners, Inc.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
   c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Gemco.
2) Midwest Fasteners, Inc.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) AGM Industries, Inc.
2) Gemco.
3) Midwest Fasteners, Inc.
4) Nelson Stud Welding.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Gemco.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire Products.
b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum in accordance with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents, unless otherwise approved by the engineer-of-record.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section 078413 "Penetration Firestopping."

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

4. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches (300 mm) o.c. and at end joints.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Outdoor, concealed supply and return.
4. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.

7. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, rectangular and round, supply, exhaust and return-air duct insulation shall be the following:

1. Glass-Fiber Blanket: 2 inches (50 mm) thick and 1.5 lb/cu. ft. (24 kg/cu. m) nominal density.

a. Jacket: FSK

3.9 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, rectangular, supply, exhaust and return-air duct insulation shall be the following:

1. Glass-Fiber Duct Board: 3 inches (75 mm) and 3 lb/cu. ft. (48 kg/cu. m) nominal density.

B. Exposed, rectangular, supply and return-air duct insulation shall be the following:

1. Glass-Fiber Duct Board: 3 inches (75 mm) and 3 lb/cu. ft. (48 kg/cu. m) nominal density.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ducts and Plenums, Concealed:

1. None.

C. Ducts and Plenums, Exposed

1. Aluminum, Smooth: 0.032 inch (0.81 mm) thick.

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SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F (minus 57 deg C) and 220 deg F (104 deg C). Comply with ASTM C534/C534M, Type I, for tubular materials, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F (minus 18 deg C).

4. Service Temperature Range: 40 to 200 deg F (4 to plus 93 deg C).
5. Color: Black.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. P.I.C. Plastics, Inc.
c. Speedline Corporation.
d. The Dow Chemical Company.

2.4 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Owens Corning.

2. Permanently flexible, elastomeric sealant.

a. Service Temperature Range: Minus 150 to plus 250 deg F (Minus 101 to plus 121 deg C).
b. Color: White or gray.

2.5 FIELD-APPLIED JACKETS

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Airex Manufacturing Inc.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.6 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Stainless Steel: ASTM A240/A240M, Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at [**2 inches (50 mm)**] [**4 inches (100 mm)**] o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using prefabricated fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with prefabricated fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where PVC jackets are indicated and for horizontal applications, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.10 SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation is the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.

C. Refrigerant Liquid Tubing:

1. All Pipe Sizes: Insulation is the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. PVC: 30 mils (0.8 mm) thick.

END OF SECTION 230719

SECTION 232300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.

B. Delegated Design Submittals: For refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.3 INFORMATIONAL SUBMITTALS

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASHRAE 15.

B. Comply with ASME B31.5.

C. Test Pressure for Refrigerant R-410A:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig (2068 kPa).
2. Suction Tubing for Heat-Pump Applications: 535 psig (3689 kPa).
3. Hot-Gas and Tubing Lines: 535 psig (3689 kPa).

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B280, Type ACR.

B. Wrought-Copper Fittings, Solder Joint: ASME B16.22.

C. Wrought-Copper Fittings, Brazed Joint: ASME B16.50.

D. Wrought-Copper Unions: ASME B16.22.

E. Brazing Filler Metals: AWS A5.8M/A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.3 REFRIGERANTS

A. R-410A, ASHRAE 34: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATION SCHEDULES

A. Refrigerant: R-410A

B. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, NPS 1-1/2 (DN 40) and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

C. Safety-Relief-Valve Discharge Tubing for Heat-Pump Applications, Copper: Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints

3.2 INSTALLATION OF PIPING, GENERAL

A. Refrigerant piping shall be sized and installed in strict accordance with manufacturer’s requirements.

B. Install refrigerant piping in accordance with ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

N. Identify refrigerant piping and valves in accordance with Section 230553 "Identification for HVAC Piping and Equipment."

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

3.3 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Brazed Joints: Construct joints in accordance with AWS BRH, "Brazing Handbook," Ch. 35, "Pipe and Tubing."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.

2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

D. Threaded Joints: Thread steel pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. (6 m) long.
2. Roller hangers and spring hangers for individual horizontal runs 20 ft. (6 m) or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. (6 m) or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches (300 mm) of each fitting.

E. Support vertical runs of copper tubing to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

END OF SECTION 232300

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Requirements:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of topof ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated Design Submittals:

1. Sheet metal thicknesses.

2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Submit shop fabrication standard indicating compliance with SMACNA performance requirements.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports are to withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches (914 mm), select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches (914 mm) or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elgen Manufacturing.
b. McGill AirFlow LLC.
c. SEMCO, LLC; part of FlaktGroup.

B. Source Limitations: Obtain single-wall round ducts and fittings from single manufacturer.

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch- (6-mm-) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch- (10-mm-) minimum diameter for lengths longer than 36 inches (900 mm).

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

2. Source Limitations: Obtain fibrous-glass duct liner from single manufacturer.
3. Maximum Thermal Conductivity:

a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F (0.033 W/m x K) at 75 deg F (24 deg C) mean temperature.

4. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
5. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick stainless steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm (12.7 m/s) or greater.
7. Secure liner with mechanical fasteners 4 inches (100 mm) from corners and at intervals not exceeding 12 inches (300 mm) transversely; at 3 inches (75 mm) from transverse joints and at intervals not exceeding 18 inches (450 mm) longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm (12.7 m/s) or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and is to be rated for10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

J. Install fire, combination fire/smoke, and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches (300 mm) and smaller and a minimum of five segments for 14 inches (350 mm) and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.

B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.

C. Single Wall:

1. Ductwork is to be galvanized steel.

2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.4 DUCT SEALING

A. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Indoor and Outdoor, Supply and Return-Air Ducts: Seal Class A.
3. Exhaust Ducts: Seal Class B.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1220 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 DUCTWORK CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

3.9 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:

1. Ducts Connected downstream of Terminal Units:

a. Pressure Class: Positive 2- (500)inch wg (Pa).
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 8.
d. SMACNA Leakage Class for Round: 4.

2. Ducts Connected to Variable-Air-Volume Rooftop Air-Handling Units:

   a. Pressure Class: Positive 4- (1000)inch wg (Pa).
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 2.
   d. SMACNA Leakage Class for Round: 2.

C. Return Ducts:

1. Ducts Connected to Rooftop Air-Handling Units:

   a. Pressure Class: Positive or negative 2- (500)inch wg (Pa).
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 8.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

   a. Pressure Class: Positive or negative 2- (500)inch wg (Pa).
   b. Minimum SMACNA Seal Class: A.
   c. SMACNA Leakage Class for Rectangular: 8.
   d. SMACNA Leakage Class for Round: 4.

E. Liner:

1. Supply and Return-Air Ducts: Fibrous glass, Type I, 5/8 (15) inch (mm) thick.

F. Elbow Configuration:

1. Rectangular Duct - Requirements for Different Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm (5 m/s) or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm (7.6 m/s) or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 (305) Inches (mm) and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 (356) Inches (mm) and Larger in Diameter: Standing seam.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Conical spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
    c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Turning vanes.
3. Duct-mounted access doors.
4. Flexible connectors.
5. Duct accessory hardware.

B. Related Requirements:

1. Section 284621.11 "Addressable Fire-Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Detail duct accessories' fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Combination fire- and smoke-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Greenheck Fan Corporation.
b. McGill AirFlow LLC.
c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
d. United Enertech Corp.

2. Performance:

a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. (203 L/s per sq. m) against 1-inch wg (250-Pa) differential static pressure.

3. Construction:

a. Linkage out of airstream.
b. Suitable for horizontal or vertical airflow applications.

4. Frames:

a. Hat-shaped, 18-gauge- (1.3-mm-) thick stainless steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized steel; 16 gauge (1.6 mm) thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:

1. Size: 0.5-inch (13-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle, made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.3 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc; a DMI company.
2. Elgen Manufacturing.
3. Ward Industries; a brand of Hart & Cooley, LLC.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

D. Vane Construction:

1. Double wall.

2.4 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc; a DMI company.
2. Elgen Manufacturing.
3. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.

4. United Enertech Corp.
5. Ward Industries; a brand of Hart & Cooley, LLC.

B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. 24-gauge- (0.70-mm-) thick galvanized steel door panel.
   d. Vision panel.
   e. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
   f. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

   a. 24-gauge- (0.70-mm-) thick galvanized steel or 0.032-inch- (0.81-mm-) thick aluminum frame.

3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges or continuous and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges or continuous and two compression latches.
   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges or continuous and two compression latches with outside and inside handles.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc; a DMI company.
2. Elgen Manufacturing.
3. Ward Industries; a brand of Hart & Cooley, LLC.

B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Materials: Flame-retardant or noncombustible fabrics.

E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

H. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

2.6 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc; a DMI company.
2. Elgen Manufacturing.
3. United Enertech Corp.
4. Ward Industries; a brand of Hart & Cooley, LLC.

B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.7 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

G. Install combination fire and smoke dampers in accordance with UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
3. Upstream or downstream from duct silencers.
4. Control devices requiring inspection.
5. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

K. Install flexible connectors to connect ducts to equipment.

L. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Operate combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

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SECTION 233433.13

COMMERCIAL AIR CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Commercial air-curtain unit.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For air curtain units.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air curtain units to include in operation and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of air curtain units that fail in materials or workmanship within specified warranty period.

1. Warranty Period (Electric Heating Units): 18 months.

PART 2 - PRODUCTS

2.1 COMMERCIAL AIR-CURTAIN UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berner International.
2. Fantech.
3. Mars Air Systems.

B. Source Limitations: Obtain air curtain from single source from single manufacturer.

C. Housing:

1. Galvanized Steel: Galvanized steel with electrostatically applied, epoxy-enamel, powder-coat finish.
2. Stainless Steel: Type 316; No. 3 finish.
3. Discharge Nozzle: Integral to housing, containing adjustable air-directional vanes with 40-degree sweep front to back.

D. Mounting Brackets: Galvanized steel, for wall mounting.

E. Air-Intake Grilles:

1. Grilles: Integral to, and same material as, housing.

F. Fans:

1. Centrifugal, forward curved, double width, double inlet.
2. Aluminum.
3. Statically and dynamically balanced.
4. Direct drive.

G. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Two speed.
3. Resiliently mounted.
4. Continuous duty.
5. Totally enclosed, air over.
6. Integral thermal-overload protection.
7. Bearings: Permanently sealed, lifetime, prelubricated, ball bearings.
8. Disconnect: Internal power cord with plug and receptacle.

H. Electric-Resistance Coils:

1. Coil Assembly: Comply with UL 1995.
2. Frame: Galvanized-steel frame.
3. Heating Elements: Open-coil resistance wire of 80 percent nickel and 20 percent chromium, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
4. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box without removing heater from duct or unit.

5. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:

a. Magnetic contactor.

b. Airflow-proving switch.

I. Controls:

1. Thermostat: Built-in; line voltage, factory installed and wired to junction box on air curtain.
2. Automatic Door Switch: Roller type, installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.
3. Start-Stop, Push-Button Switch: Manually activates and deactivates air curtain.
4. Three-Speed Switch: Manually activates, deactivates, and controls air-curtain fan speed.
5. Time-Delay Relay: Factory installed and adjustable to allow air curtain to operate from 0.5 seconds to 10 hours.
6. Motor-Control Panel: Complete with motor starter, 115-V ac transformer with primary and secondary fuses, terminal strip, and NEMA 250, Type 1 enclosure.

J. Accessories:

1. Mounting Brackets: Adjustable mounting brackets for wall mounting.
2. Discharge Extension Neck: For ceiling-recessed installation.

2.2 SOURCE QUALITY CONTROL

A. Source Quality Control: Test to 300 and 200 psig (2070 and 1380 kPa) underwater.

B. Testing: Test and inspect steam coils in accordance with ASHRAE 33.

C. AMCA Certification for Fan Aerodynamic Performance Rating: Test, rate, and label, air curtain units in accordance with AMCA 211.

D. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label, air curtain units in accordance with AMCA 311.

E. Comply with AHRI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils," for components, construction, and rating.

F. ASHRAE 90.1-2019, Section 10.4.5: Air curtain units shall be tested in accordance with ANSI/AMCA 220 or ISO 27327-1.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

H. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine work areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install air curtains with clearance for equipment service and maintenance.

B. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 ADJUSTING

A. Adjust motor speed to achieve specified airflow.

B. Adjust discharge louver and dampers to regulate airflow.

C. Adjust air-directional vanes.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Air curtain units shall be tested, installed, and commissioned in accordance with ASHRAE 90.1-2019 Section 10.4.5.

C. Tests and Inspections:

1. After installing air curtains completely, perform visual and mechanical check of individual components.

2. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air-curtain unit will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial air curtains.

1. Duration: Minimum 1-hour.

END OF SECTION 233433.13

SECTION 233713.13

AIR DIFFUSERS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Square ceiling diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished. Schedule shall indicate performance and NC level at design airflows.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck.
2. Price Industries Limited.
3. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material: Steel.

D. Finish: Baked enamel, white.

E. Face Size: 24 by 24 inches (600 by 600 mm).

F. Face Style: Plaque.

G. Mounting: T-bar.

H. Pattern: Fixed.

I. Dampers: None.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

B. NC shall not exceed Max NC as scheduled at design airflow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233713.23

REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adjustable blade face registers.
2. Fixed face grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
   b. Price Industries Limited.
   c. Titus; brand of Johnson Controls International plc, Global Products.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch (19 mm) apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inch (19 mm) apart.
7. Frame: 1-1/4 inches (32 mm) wide.
8. Mounting: Countersunk screw.

2.2 GRILLES

A. Fixed Face Grille <Insert drawing designation>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
   b. Price Industries Limited.
   c. Titus; brand of Johnson Controls International plc, Global Products.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal; spaced 3/4 inch (19 mm) apart.
5. Face Arrangement: Perforated core.
6. Core Construction: Integral.
7. Frame: 1-1/4 inches (32 mm) wide.
8. Mounting: Countersunk screw.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 237416.13

PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Packaged, large-capacity, rooftop air conditioning units.

1.2 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

a. Include certified fan-performance curves with system operating conditions indicated.
b. Include certified fan-sound power ratings.
c. Include fan construction and accessories.
d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranty.

B. Source quality-control reports.

C. System startup reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.
2. Gaskets: One set for each access door.
3. Fan Belts: One set for each belt-driven fan.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Minimum EER Rating: 11.0.

2.2 PACKAGED ROOFTOP AIR-CONDITIONING UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin Applied.
2. Engineered Air.
3. YORK; brand of Johnson Controls International plc, Building Solutions North America.

B. Unit Casings:

1. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
2. Double-Wall Construction:

a. Outside Casing Wall: Galvanized steel, minimum 18 gauge (1.3 mm) thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
b. Inside Casing Wall: G90 (Z275)-coated galvanized steel, 0.034 inch (0.86 mm) thick.
c. Floor Plate: G90 (Z275) galvanized steel,minimum 18 gauge (1.3 mm) thick.
d. Casing Insulation:

1) Materials: Injected polyurethane foam insulation.
2) Casing Panel R-Value: Minimum 7.0.
3) Insulation Thickness: 1 inch (25 mm).
4) Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

3. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
4. Static-Pressure Classifications:

a. For Unit Sections Upstream of Fans: Minus 3-inch wg (750 Pa).
b. For Unit Sections Downstream and Including Fans: 4-inch wg (1000 Pa).

5. Panels and Doors:

a. Access Doors:

1) Hinges: A minimum of two ball-bearing hinges or stainless steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
2) Gasket: Neoprene, applied around entire perimeters of panel frames.
3) Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches (450 mm) wide by full height of unit casing up to a maximum height of 60 inches (1500 mm).

b. Locations and Applications:

1) Fan Section: Doors.
2) Access Section: Doors.
3) Coil Section: Inspection and access panels.

4) Damper Section: Doors.
5) Filter Section: Doors large enough to allow periodic removal and installation of filters.
6) Mixing Section: Doors.

6. Condensate Drain Pans:

a. Location: Each type of cooling coil.

1) Single-wall, stainless steel sheet.

b. Drain Connection:

1) Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
2) Minimum Connection Size: NPS 1 (DN 25).

c. Slope: Minimum 0.125-in./ft. (10-mm/mm) slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
d. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
e. Width: Entire width of water producing device.
f. Depth: A minimum of 2 inches (50 mm) deep.
g. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

C. Fans, Drives, and Motors:

1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
2. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

a. Shafts: With field-adjustable alignment.

1) Turned, ground, and polished hot-rolled steel with keyway.

b. Shaft Bearings:

1) Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.

c. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

1) Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

d. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.

e. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch (25 mm).
f. Shaft Lubrication Lines: Extended to a location outside the casing.
g. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches (89 mm) wide, attached to two strips of minimum 2-3/4-inch- (70-mm-)wide by 0.028-inch- (0.7-mm-) thick, galvanized-steel sheet.

1) Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

3. Drives, Direct: Factory-mounted, direct drive.

4. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated ECMmotors.
5. Exhaust-Air Fan: Single width, single inlet (SWSI) airfoil centrifugal, shaft mounted on permanently lubricated motor.
6. Motors:

a. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

D. Rotary Heat Exchangers:

1. Casing:

a. Galvanized steel, stainless steel, or aluminum with manufacturer's standard factory finish.
b. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg (0.5 percent at 400-Pa and 0.20 percent at 1000-Pa) differential pressure.
c. Casing seals on periphery of rotor, on duct divider, and on purge section.
d. Support vertical rotors on grease-lubricated ball bearings with extended grease fittings. Mount horizontal rotors on tapered roller bearing.

2. Rotor - Aluminum or Polymer: Segmented wheel, strengthened with radial spokes, with nontoxic, noncorrosive, silica-gel desiccant coating.
3. Drive: Fractional horsepower motor and gear reducer. Permanently lubricated wheel bearings with an L-10 400,000 hours.
4. Controls:

a. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
b. A. The unit controller shall proportional control the ECM motors on the supply fan based on space temperature. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the space temperature within its setpoint and deadband. The unit controller shall provide discharge air temperature control with the compressor modulation.

E. Coils:

1. General Requirements for Coils:

    a. Comply with AHRI 410.
    b. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
    c. Coils shall not act as structural component of unit.

2. Supply-Air Refrigerant Coil:

    a. Tubes: Copper.
    b. Fins:

        1) Material: Aluminum.
        2) Fin Spacing: Maximum 12 fins per inch (mm).

    c. Fin and Tube Joints: Mechanical bond.
    d. Headers: Seamless-copper headers with brazed connections.
    e. Frames: Galvanized or steel Stainless steel.
    f. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

        1) Working Pressure: Minimum 300 psig (2070 kPa).

3. Electric-Resistance Heating Coils: Comply with UL 1995.

    a. Casing Assembly: Slip-in or Flanged type with galvanized-steel frame.
    b. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
    c. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
    d. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
    e. Control Panel: Unit mounted with disconnecting means and overcurrent protection.

        1) Magnetic or Mercury contactor.
        2) Solid-state, stepless pulse controller.
        3) Toggle switches, one per step.
        4) Step controller.
        5) Time-delay relay.
        6) Pilot lights, one per step.
        7) Airflow proving switch.

F. Refrigerant Circuit Components:
    1. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief.
    2. Refrigeration Specialties:

        a. Refrigerant: R-410A.
        b. Expansion valve with replaceable thermostatic element.
        c. Refrigerant filter/dryer.
        d. Manual-reset high-pressure safety switch.
        e. Automatic-reset low-pressure safety switch.

f. Minimum off-time relay.
g. Automatic-reset compressor motor thermal overload.
h. Brass service valves installed in compressor suction and liquid lines.
i. Hot-gas reheat solenoid valve modulatingwith a replaceable magnetic coil.
j. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

G. Air Filtration:

1. Panel Filters:

a. Description: Pleatedfactory-fabricated, self-supported, disposable air filters with holding frames.
b. Filter Unit Class: UL 900.
c. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
d. Provide 2" MERV 8 Filter at Outside Air intake prior to Energy Recover Wheel.

H. Dampers:
1. Outdoor-air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement withsteel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. (20 L/s per sq. m) at 1-inch wg (250 Pa) and 8 cfm/sq. ft. (40 L/s per sq. m) at 4-inch wg (1.0 MPa) rated in accordance with AMCA 500D.)
2. Barometric relief dampers.
3. Electronic Damper Operators:

a. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
b. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
c. Operator Motors:

1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
2) Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
3) Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

d. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
e. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
f. Size dampers for running torque calculated as follows:

1) Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
2) Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.

3) Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
4) Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
5) Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
6) Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

g. Coupling: V-bolt and V-shaped, toothed cradle.
h. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
i. Fail-Safe Operation: Mechanical, spring-return mechanism with external, manual gear release on nonspring-return actuators.

I. Electrical Power Connections:

1. RTU is to have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

J. Controls:
1. Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.
2. The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.
3. The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.
4. All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.
5. The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.
6. The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:
a. Return air temperature.

b. Discharge air temperature.
c. Outdoor air temperature.
d. Space air temperature.
e. Outdoor enthalpy, high/low.
f. Compressor suction temperature and pressure
g. Compressor head pressure and temperature
h. Expansion valve position
i. Condenser fan speed
j. Inverter compressor speed
k. Dirty filter indication.
l. Airflow verification.
m. Cooling status.
n. Control temperature (Changeover).
o. VAV box output status.
p. Cooling status/capacity.
q. Unit status.
r. All time schedules.
s. Active alarms with time and date.
t. Previous alarms with time and date.
u. Optimal start
v. Supply fan and exhaust fan speed.
w. System operating hours.
    1) Fan
    2) Exhaust fan
    3) Cooling
    4) Inndividual compressor
    5) Heating
    6) Economizer
    7) Tenant override

7. The user interaction with the keypad shall provide the following:
    a. Controls mode
        1) Off manual
        2) Auto
        3) Heat/Cool
        4) Cool only
        5) Heat only
        6) Fan only
    b. Occupancy mode
        1) Auto
        2) Occupied
        3) Unoccupied
        4) Tenant override
    c. Unit operation changeover control
        1) Return air temperature
        2) Space temperature
        3) Network signal
    d. Cooling and heating change-over temperature with deadband
    e. Cooling discharge air temperature (DAT)
    f. Supply reset options
        1) Return air temperature
        2) Outdoor air temperature
        3) Space temperature
        4) Airflow (VAV)
        5) Network signal
        6) External (0-10 vdc)
        7) External (0-20 mA)

g. Temperature alarm limits
   1) High supply air temperature
   2) Low supply air temperature
   3) High return air temperature
h. Lockout control for compressors.
i. Compressor interstage timers
j. Night setback and setup space temperature.
k. Building static pressure.
l. Economizer changeover
   1) Enthalpy
   2) Drybulb temperature
m. Currently time and date
n. Tenant override time
o. Occupied/unoccupied time schedule
p. One event schedule
q. Holiday dates and duration
r. Adjustable set points
s. Service mode
   1) Timers normal (all time delays normal)
   2) Timers fast (all time delays 20 sec)

8. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include:
   a. Zone sensor with tenant override switch
   b. Zone sensor with tenant override switch plus heating and cooling set point adjustment. (Space Comfort Control systems only)
9. To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:
   a. Airflow
   b. Outside air temperature
   c. Space temperature
   d. Return air temperature
   e. External signal of 1-5 vdc
   f. External signal of 0-20 mA
   g. Network signal

10. Interface Requirements for HVAC Instrumentation and Control System:

    a. Interface relay for scheduled operation.
    b. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
    c. Provide BACnet or LonWorks compatible interface for central HVAC control workstation for the following:

       1) Adjusting set points.
       2) Monitoring supply fan start, stop, and operation.
       3) Inquiring data to include supply- and room-air temperature and humidity.
       4) Monitoring occupied and unoccupied operations.
       5) Monitoring constant and variable motor loads.
       6) Monitoring variable-frequency drive operation.
       7) Monitoring cooling load.
       8) Monitoring economizer cycles.
       9) Monitoring air-distribution static pressure and ventilation air volume.

K. Roof Curbs:

1. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.
2. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

    a. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

        1) Materials: ASTM C1071, Type I or II.
        2) Thickness: 2 inches (50 mm).

    b. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

        1) Liner Adhesive: Comply with ASTM C916, Type I.
        2) Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
        3) Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.

3. Curb Dimensions: Height of 24 inches (610 mm).

L. Accessories:

1. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required.
2. Low-ambient kit using variable-speed condenser fans for operation down to 25 deg F.
3. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
4. Factory- or field-installed demand-controlled ventilation.
5. Safeties:

    a. Smoke detector.
    b. Electric coil airflow-proving switch.

6. Outdoor air intake weather hood.

2.3 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209 (ASTM B209M).

2.4 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PACKAGED ROOFTOP AIR-CONDITIONING UNITS

A. Unit Support: Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure RTUs to structural support with anchor bolts.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4 (DN 32), ASTM B88, Type M (ASTM B88M, Type C) copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch (13 mm) high.
2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Remove packing from vibration isolators.

11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.

17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F (8 deg C) above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

23. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

24. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems and after completing startup service, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Testing Agency:

1. Engage a qualified testing agency to perform tests and inspections.
2. Coordinate with controls contractor for unit commissioning.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. RTU will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

1. Duration: Minimum 2-hours.

END OF SECTION 237416.13

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Split-system air-conditioners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Piping Diagrams: Include sizes, verified lengths and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each indoor unit.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.7 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five Insert number year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SPLIT-SYSTEM AIR-CONDITIONERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daikin (Basis of Design).
2. Mitsubishi Electric & Electronics USA, Inc.
3. Trane.

B. Indoor Units:

1. General: The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.

2. Unit Cabinet:

a. The indoor unit shall have a white, “wipe-clean” finish.
b. The drain and refrigerant piping shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom.
c. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.
d. The cabinet includes:

1) Indoor unit ON/OFF switch, capable of being used when the remote controller is missing. When switch is used, the default setting is AUTO mode, 77°F temperature setting, and AUTO airflow rate.
2) "Intelligent Eye" motion sensor capable of setting back the set point temperature for energy savings. This feature may be disengaged on the I/R remote controller.
3) OPERATION lamp that turns green when activated
4) TIMER lamp that turns orange when activated
5) A Signal Receiver that receives signals from the remote controller at a maximum distance of 23 ft. When the unit receives a signal, you shall hear the following: 2 beeps – operation start, 1 beep – Setting changed, 1 long beep – Operation stop.

3. Fan:

a. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor.
b. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
c. An auto-swing louver for adjustable air flow (both vertically and horizontally) is standard via the wireless remote control furnished with each system.
d. The indoor fan shall offer a choice of five speeds, plus quiet and auto settings.
e. The fan shall have a delayed start when initially put into HEAT operation, giving time for the evaporator coil to heat up and preventing a cold draft from entering the room.

4. Filter:

a. The return air filter provided shall be a mildew resistant, removable and washable filter. Two titanium apatite photocatalytic air purifying filters shall be included for additional air filtration.

5. Coil:

a. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
b. All tube joints shall be brazed with silver alloy or phoscopper.
c. All coils shall be factory pressure tested.
d. A condensate pan shall be provided under the coil with a drain connection.

6. Electrical:

a. The outdoor unit shall be powered with 208-230 volts, 1 phase, and 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power from the outdoor unit.
b. The allowable voltage range shall be 187 volts to 253 volts.

7. Control:

a. The unit shall have a backlit, wireless remote infra-red controller capable to operate the system. It shall have Cooling Operation, Heating Operation, Automatic Operation, Dry Operation and Fan Only Operation.
b. The controller shall consist of an On/Off Power switch, Mode Selector, Quiet Button (for outdoor unit), Fan Setting, Swing Louver, On/Off Timer Setting, Temperature Adjustment, °C or °F Temperature Display, Intelligent Eye Sensor,

Weekly Timer, Night Set Mode, Comfort Mode, Econo Mode, and Powerful Operation.

c. The controller shall be able to display two-digit fault codes extracted from the indoor unit to aid in troubleshooting.
d. Temperature range on the remote control shall be 64°F to 90°F in COOL mode, 50°F to 86°F in HEAT mode, and 64°F to 86°F in AUTO mode. The temperature shall be controlled in 1° increments.
e. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote control.
f. The unit shall also have the capability to connect to a smart-device app via wireless adapter.

C. Outdoor Units:

1. General: The outdoor unit shall be specifically matched to corresponding indoor units while not exceeding maximum connected capacity. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls. The outdoor unit shall be controlled by a microprocessor and dedicated EEV's shall be provided for capacity control during part load of the indoor unit.

2. Unit Cabinet:

a. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proof mild steel panels coated with a baked enamel finish.
b. The outdoor unit shall come furnished with four (4) mounting feet, mounted across the base pan, to allow bolting to a cement pad or optionally supplied mounting bracket.
c. The assembly shall be able to withstand a maximum rated wind pressure of 119psf Lateral, 93psf Uplift.

3. Fan:

a. The fan shall be a direct drive, propeller type fan.
b. The motor shall be inverter driven, permanently lubricated type bearings, inherent.
c. The fan shall be capable of operating in "Quiet Operation" which lowers the outdoor fan speed in either COOL, HEAT, or AUTO modes.
d. A fan guard shall be provided on the outdoor unit to prevent contact with fan operation.
e. Airflow shall be horizontal discharge.

4. Coil:

a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
b. The fins shall be covered with an anti-corrosion acrylic resin and hydrophilic film type E1, rated for up to 1000 hours salt spray.
c. Refrigerant flow from the condenser shall be controlled via a metering device.
d. Intelligent defrost shall start automatically to remove any frost from the outdoor unit allowing the system to maintain heating capacity. Additionally, the unit shall review previous cycle and adjust defrost mode start time and duration.

5. Compressor:

a. The outdoor compressor shall be a patented, variable speed swing inverter-driven compressor.
b. The outdoor unit shall have an accumulator and four-way reversing valve.
c. PVE Refrigerant Oil shall be used to provide improved lubrication & better chemical stability, and no hydrolysis, leading to higher product reliability.
d. The compressor shall have an internal thermal overload.
e. The outdoor unit shall operate with a maximum refrigerant piping of 262 feet (maximum 98 feet per indoor unit), with 49 feet maximum vertical difference between indoor unit and outdoor unit (maximum 24 feet between indoor units), without any oil traps, BP boxes, or additional components.
f. The compressor shall have a quick-warming function to prevent pumping liquid refrigerant in low-ambient conditions.

6. Electrical:

a. The electrical power requirement is 208-230 volt, 1-phase, and 60 Hz power.
b. The voltage range limitations shall be a minimum of 187 volts and a maximum of 253 volts.

7. Sound:

a. Outdoor unit sound levels shall not exceed:

1) Cooling Mode Sound Level: 53 dB(A)
2) Heating Mode Sound Level: 55 dB(A)

a) Values are measured approximately 3 feet away with JIS standard operating conditions.
b) Outdoor unit shall be equipped with optional Night Quiet Mode for COOL operation. Night Quiet reduces the operation noise during night-time hours and is engaged via dipswitch setting during installation.
c) Night Quiet mode shall be activated when temperature drops 10.8°F or more below the highest temperature recorded that day. Function shall be cancelled when the temperature difference between the current outdoor temperature and the maximum outdoor temperature becomes less than 7.2°F.

D. SYSTEM DIAGNOSTICS

1. General: The system shall be capable of producing 2-digit fault codes:

a. Controls – compatibility varies by indoor unit model.

1) I/R controller
2) Wired Controller
3) Wi-fi module

b. Diagnostic Software: The diagnostic software shall have the ability to display error codes and values for every sensor on the system through the outdoor unit. The sensor data points shall be graphed or recorded for export to a spreadsheet. The spreadsheet can then be analyzed to troubleshoot operational issues or acknowledge proper operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting: Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

1. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Prior to system charge, provide micron test below 500 microns for 1-hour minimum and as recommended by manufacturer.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Duration: Minimum 1-hour.

END OF SECTION 238126

SECTION 260010

SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies supplemental requirements generally applicable to the Work specified in Division 26. This Section is also referenced by related Work specified in other Divisions.

B. Related Requirements:

1. Section 260011 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. 8P8C: An 8-position 8-contact modular jack.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AIC: Ampere interrupting capacity.
6. AL, Al, or ALUM: Aluminum.
7. ASD: Adjustable-speed drive; also called "variable-frequency drive" (VFD).
8. ATS: Automatic transfer switch.
9. AWG: American wire gauge; see ASTM B258.
10. BAS: Building automation system.
11. BIL: Basic impulse insulation level.
12. BIM: Building information modeling.
13. CAD: Computer-aided design or drafting.
14. CATV: Community antenna television.
15. CB: Circuit breaker.
16. cd: Candela, the SI fundamental unit of luminous intensity.
17. CO/ALR: Copper-aluminum, revised.
18. COPS: Critical operations power system.
19. CU or Cu: Copper.
20. CU-AL or AL-CU: Copper-aluminum.
21. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
22. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
23. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
24. dBm: Decibel absolute power with respect to 1 mW.
25. DC or dc: Direct current.
26. DCOA: Designated critical operations area.
27. DDC: Direct digital control (HVAC).

28. EGC: Equipment grounding conductor.
29. ELV: Extra-low voltage.
30. EMF: Electromotive force.
31. EMI: Electromagnetic interference.
32. EPM: Electrical preventive maintenance.
33. EPS: Emergency power supply.
34. EPSS: Emergency power supply system.
35. ESS: Energy storage system.
36. EV: Electric vehicle.
37. EVPE: Electric vehicle power export equipment.
38. EVSE: Electric vehicle supply equipment.
39. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
40. FLC: Full-load current.
41. ft: Foot.
42. ft-cd: Foot-candle, the antiquated U.S. Standard unit of illuminance, equal to one international candle measured at a distance of one foot, that was superseded in 1948 by the unit "footcandle" after the SI unit candela (cd) replaced the international candle; see "fc,"
43. GEC: Grounding electrode conductor.
44. GFCI: Ground-fault circuit interrupter.
45. GFPE: Ground-fault protection of equipment.
46. GND: Ground.
47. HACR: Heating, air conditioning, and refrigeration.
48. HDPE: High-density polyethylene.
49. HID: High-intensity discharge.
50. HP or hp: Horsepower.
51. HVAC: Heating, ventilating, and air conditioning.
52. Hz: Hertz.
53. IBT: Intersystem bonding termination.
54. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
55. IP: Ingress protection rating (enclosures); Internet protocol (communications).
56. IR: Infrared.
57. IS: Intrinsically safe.
58. IT&R: Inspecting, testing, and repair.
59. ITE: Information technology equipment.
60. kAIC: Kiloampere interrupting capacity.
61. kcmil or MCM: One thousand circular mils.
62. kV: Kilovolt.
63. kVA: Kilovolt-ampere.
64. kVAr or kVAR: Kilovolt-ampere reactive.
65. kW: Kilowatt.
66. kWh: Kilowatt-hour.
67. LAN: Local area network.
68. lb: Pound (weight).
69. lbf: Pound (force).
70. LCD: Liquid-crystal display.
71. LCDI: Leakage-current detector-interrupter.
72. LED: Light-emitting diode.
73. Li-ion: Lithium-ion.
74. lm: Lumen, the SI derived unit of luminous flux.
75. LNG: Liquefied natural gas.
76. LP-Gas: Liquefied petroleum gas.
77. LRC: Locked-rotor current.

78. LV: Low voltage.
79. lx: Lux, the SI derived unit of illuminance equal to one lumen per square meter.
80. m: Meter.
81. MCC: Motor-control center.
82. MDC: Modular data center.
83. MG set: Motor-generator set.
84. MIDI: Musical instrument digital interface.
85. MLO: Main lugs only.
86. MV: Medium voltage.
87. MVA: Megavolt-ampere.
88. mW: Milliwatt.
89. MW: Megawatt.
90. MWh: Megawatt-hour.
91. NC: Normally closed.
92. Ni-Cd: Nickel-cadmium.
93. Ni-MH: Nickel-metal hydride.
94. NIU: Network interface unit.
95. NO: Normally open.
96. NPT: National (American) standard pipe taper.
97. OCPD: Overcurrent protective device.
98. ONT: Optical network terminal.
99. PC: Personal computer.
100. PCS: Power conversion system.
101. PCU: Power-conditioning unit.
102. PF or pf: Power factor.
103. PHEV: Plug-in hybrid electric vehicle.
104. PLC: Programmable logic controller.
105. PLFA: Power-limited fire alarm.
106. PoE: Power over Ethernet.
107. PV: Photovoltaic.
108. PVC: Polyvinyl chloride.
109. pW: Picowatt.
110. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
111. RMS or rms: Root-mean-square.
112. RPM or rpm: Revolutions per minute.
113. SCADA: Supervisory control and data acquisition.
114. SCR: Silicon-controlled rectifier.
115. SPD: Surge protective device.
116. sq.: Square.
117. SWD: Switching duty.
118. TCP/IP: Transmission control protocol/Internet protocol.
119. TEFC: Totally enclosed fan-cooled.
120. TR: Tamper resistant.
121. TVSS: Transient voltage surge suppressor.
122. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.
123. UL CCN: UL Category Control Number.
124. UPS: Uninterruptible power supply.
125. USB: Universal serial bus.
126. UV: Ultraviolet.
127. V: Volt, unit of electromotive force.
128. V(ac): Volt, alternating current.
129. V(dc): Volt, direct current.
130. VA: Volt-ampere, unit of complex electrical power.
131. VAR: Volt-ampere reactive, unit of reactive electrical power.
132. VFC: Variable-frequency controller.
133. VOM: Volt-ohm-multimeter.

134. VPN: Virtual private network.
135. VRLA: Valve regulated lead acid; also called "sealed lead acid (SLA)" or "valve regulated sealed lead acid."
136. W: Watt, unit of real electrical power.
137. Wh: Watt-hour, unit of electrical energy usage.
138. WPT: Wireless power transfer.
139. WPTE: Wireless power transfer equipment.
140. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

1. CR: Communications raceway.
2. CR-GP: General-purpose communications raceway.
3. CR-P: Plenum communications raceway.
4. CR-R: Riser communications raceway.
5. EMT: Electrical metallic tubing.
6. EMT-A: Aluminum electrical metallic tubing.
7. EMT-S: Steel electrical metallic tubing.
8. EMT-SS: Stainless steel electrical metallic tubing.
9. ENT: Electrical nonmetallic tubing.
10. EPEC: Electrical HDPE underground conduit (thin wall).
11. EPEC-A: Type A electrical HDPE underground conduit.
12. EPEC-B: Type B electrical HDPE underground conduit.
13. ERMC: Electrical rigid metal conduit.
14. ERMC-A: Aluminum electrical rigid metal conduit.
15. ERMC-S: Steel electrical rigid metal conduit.
16. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
17. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
18. ERMC-SS: Stainless steel electrical rigid metal conduit.
19. FMC: Flexible metal conduit.
20. FMC-A: Aluminum flexible metal conduit.
21. FMC-S: Steel flexible metal conduit.
22. FMT: Steel flexible metallic tubing.
23. FNMC: Flexible nonmetallic conduit. See "LFNC."
24. HDPE: HDPE underground conduit (thick wall).
25. HDPE-40: Schedule 40 HDPE underground conduit.
26. HDPE-80: Schedule 80 HDPE underground conduit.
27. IMC: Steel electrical intermediate metal conduit.
28. LFMC: Liquidtight flexible metal conduit.
29. LFMC-A: Aluminum liquidtight flexible metal conduit.
30. LFMC-S: Steel liquidtight flexible metal conduit.
31. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
32. LFNC: Liquidtight flexible nonmetallic conduit.
33. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
34. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
35. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
36. OFR: Optical fiber raceway.
37. OFR-GP: General-purpose optical fiber raceway.
38. OFR-P: Plenum optical fiber raceway.
39. OFR-R: Riser optical fiber raceway.
40. PVC: Rigid PVC conduit.
41. PVC-40: Schedule 40 rigid PVC conduit.
42. PVC-80: Schedule 80 rigid PVC Conduit.
43. PVC-A: Type A rigid PVC concrete-encased conduit.
44. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
45. RGS: See ERMC-S-G.

46. RMC: See ERMC.
47. RTRC: Reinforced thermosetting resin conduit.
48. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
49. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
50. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
51. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
52. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.
4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.
31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: (machine tool wiring) Moisture-, heat-, and oil-resistant thermoplastic cable.
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.

42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: (high heat) Thermoset rubber, heat-resistant cable.
54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.
56. SE: Service-entrance cable.
57. SER: Service-entrance cable, round.
58. SEU: Service-entrance cable, flat.
59. SIS: Thermoset cable for switchboard and switchgear wiring.
60. TBS: Thermoplastic cable with outer braid.
61. TC: Tray cable.
62. TC-ER: Tray cable, exposed run.
63. TC-ER-HL: Tray cable, exposed run, hazardous location.
64. THW: Thermoplastic, heat- and moisture-resistant cable.
65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
66. THHW: Thermoplastic, heat- and moisture-resistant cable.
67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
68. TW: Thermoplastic, moisture-resistant cable.
69. UF: Underground feeder and branch-circuit cable.
70. USE: Underground service-entrance cable.
71. XHH: Cross-linked polyethylene, heat-resistant cable.
72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Abbreviations and Acronyms for Electrical Flexible Cord Types:

1. SEO: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
2. SEOW: 600 V extra-hard-usage, hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
3. SEOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp locations.
4. SEOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer covering for damp or wet locations.
5. SJEO: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
6. SJEOW: 300 V hard-usage, junior hard-service cord with thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.
7. SJEOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp locations.
8. SJEOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic elastomer insulation and oil-resistant thermoplastic elastomer outer cover for damp or wet locations.

9. SJO: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp locations.
10. SJOW: 300 V hard-usage, junior hard-service cord with thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
11. SJOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp locations.
12. SJOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer cover for damp or wet locations.
13. SJTO: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
14. SJTOW: 300 V hard-usage, junior hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
15. SJTOO: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp locations.
16. SJTOOW: 300 V hard-usage, junior hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer cover for damp or wet locations.
17. SO: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp locations.
18. SOW: 600 V extra-hard-usage, hard-service cord with thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
19. SOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp locations.
20. SOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoset insulation and oil-resistant thermoset outer covering for damp or wet locations.
21. STO: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
22. STOW: 600 V extra-hard-usage, hard-service cord with thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.
23. STOO: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp locations.
24. STOOW: 600 V extra-hard-usage, hard-service cord with oil-resistant thermoplastic insulation and oil-resistant thermoplastic outer covering for damp or wet locations.

E. Definitions:

1. 8-Position 8-Contact (8P8C) Modular Jack: An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Also called a "TIA-1096 miniature 8-position series jack" (8PSJ), or an "IEC 8877 8-pole jack."

    a. Be careful when suppliers use "RJ45" generically. Obsolete RJ45 jacks used for analog telephone cables have rejection keys. 8P8C jacks used for digital telephone cables and Ethernet cables do not have rejection keys.

2. Basic Impulse Insulation Level (BIL): Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
3. Cable: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "cable" is (1) a conductor with insulation, or a stranded conductor with or without insulation (single-conductor cable); or (2) a combination of conductors insulated from one another (multiple-conductor cable).
4. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
5. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.

6. Conductor: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "conductor" is (1) a wire or combination of wires not insulated from one another, suitable for carrying an electric current; (2) (National Electrical Safety Code) a material, usually in the form of wire, cable, or bar, suitable for carrying an electric current; or (3) (general) a substance or body that allows a current of electricity to pass continuously along it.
7. Designated Seismic System: A system component that requires design in accordance with Ch. 13 of ASCE/SEI 7 and for which the Component Importance Factor is greater than 1.0.
8. Direct Buried: Installed underground without encasement in concrete or other protective material.
9. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:

    a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
    b. Concrete Box: A box intended for use in poured concrete.
    c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
    d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
    e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
    f. Device Box: A box with provisions for mounting a wiring device directly to the box.
    g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
    h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
    i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
    j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
    k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
    l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
    m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
    n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
    o. Raised-Floor Box: A floor box intended for use in raised floors.
    p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.

q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
r. Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
t. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.

10. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
11. Essential Electrical Systems: (healthcare facilities) Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.
12. Fault Limited: Providing or being served by a source of electrical power that is limited to not more than 100 W when tested in accordance with UL 62368-1.

    a. The term "fault limited" is intended to encompass most Class 1, 2, and 3 power-limited sources complying with Article 725 of NFPA 70; Class ES1 and ES2 electrical energy sources that are Class PS1 electrical power sources (e.g., USB); and Class ES3 electrical energy sources that are Class PS1 and PS2 electrical power sources (e.g., PoE). See UL 62368-1 for discussion of classes of electrical energy sources and classes of electrical power sources.

13. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.
14. Jacket: A continuous nonmetallic outer covering for conductors or cables.
15. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
16. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
17. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
18. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
19. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
20. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
21. Sheath: A continuous metallic covering for conductors or cables.
22. UL Category Control Number (CCN): An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
23. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
c. Extra-Low Voltage (ELV): Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
d. Low Voltage (LV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
e. Medium Voltage (MV): Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.

24. Wire: In accordance with NIST NBS Circular 37 and IEEE standards, in the United States for the purpose of interstate commerce, the definition of "wire" is a slender rod or filament of drawn metal. A group of small wires used as a single wire is properly called a "stranded wire." A wire or stranded wire covered with insulation is properly called an "insulated wire" or a "single-conductor cable." Nevertheless, when the context indicates that the wire is insulated, the term "wire" will be understood to include the insulation.

1.3 COORDINATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Architect or Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's or Construction Manager's written permission.
3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:

a. Exercising generators.
b. Emergency lighting.
c. Elevators.
d. Fire-alarm systems.

B. Arrange to provide temporary electrical service or power in accordance with requirements specified in Division 01.

1.4 PREINSTALLATION MEETINGS

A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner, not later than 10 days after notice to proceed. Agenda topics include, but are not limited to, the following:

1. Electrical installation schedule.

2. Status of power system studies.
3. Value analysis proposals and requests for substitution of electrical equipment.
4. Utility work coordination and class of service requests.
5. Commissioning activities.
6. Sustainability activities, including Measurement and Verification Plan.

1.5 SEQUENCING

A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.6 ACTION SUBMITTALS

A. Coordination drawings.

1.7 INFORMATIONAL SUBMITTALS

A. Electrical installation schedule.

B. Qualification statements.

C. Welding certificates.

D. Seismic-load performance certificates and wind-load performance certificates.

E. Delegated design drawings for structural masonry wall penetrations.

1.8 CLOSEOUT SUBMITTALS

A. Facility EPM program binders.

B. Operation and maintenance data.

C. Software and firmware operational documentation.

D. Software.

1.9 QUALITY ASSURANCE

A. Qualifications: Prepare and submit qualification statements for the following entities performing Work on Project:

1. Qualified Regional Manufacturer: Manufacturer, possessing qualifications specified in Section 014000 "Quality Requirements," that maintains a service center capable of providing training, parts, and emergency on-site repairs to Project site with response time less than eight hours.
2. Structural Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in structural engineering, including seismic- and wind-load modeling and analysis.

3. Electrical Professional Engineer: Professional engineer possessing active qualifications specified in Section 014000 "Quality Requirements," with expertise in electrical engineering, including electrical power system modeling and analysis of electrical safety in accordance with NFPA 70E.
4. Lighting Professional Engineer: Professional engineer possessing active qualifications in accordance with Section 014000 "Quality Requirements" and the following:

    a. Expertise in electrical engineering, lighting design, and structural requirements for exterior poles and standards.
    b. Lighting Certified (LC) Professional by the National Council on Qualifications for the Lighting Professions (NCQLP).

5. EPM Specialist: Recognized experts possessing the following qualifications in accordance with Section 014000 "Quality Requirements" and NFPA 70B:

    a. Technical Competence: Person should, by education, training, and experience, be well-rounded in all aspects of electrical maintenance.
    b. Administrative and Supervisory Skills: Person should be skilled in planning and development of long-range objectives to achieve specific results and should be able to command respect and solicit cooperation of persons involved in EPM Program development.

6. Welder: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," with training and certification in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M.
7. ERMC-S-PVC Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired certified Installer credentials issued by ERMC-S-PVC manufacturer prior to starting installation.
8. Medium-Voltage Cable Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with training and manufacturer certification to install, splice, and terminate medium-voltage cable in accordance with electrical utility service provider's requirements.

    a. Medium-voltage cable Installer must be approved by BGE.

9. Medium-Voltage Duct Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with installation of medium-voltage duct banks[**in accordance with electrical utility service provider's requirements**].

    a. Medium-voltage duct Installer must be approved by BGE.

10. Medium-Voltage Equipment Installer: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with hazards and safety requirements associated with installation and operation of medium-voltage equipment in accordance with electrical utility service provider requirements.

    a. Medium-voltage equipment Installer must be approved by BGE.

11. Electrical Power Monitoring Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired certified Installer credentials issued by manufacturer prior to starting installation.
12. EVSE Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired certified Installer credentials issued by EVSE manufacturer prior to starting installation.

13. Generator Set Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired certified Installer credentials issued by generator set manufacturer prior to starting installation.
14. Lightning Protection System Installers: Installer possessing active qualifications specified in Section 014000 "Quality Requirements," and able to present unexpired UL-Listed Installer, UL Category Control Number OWAY, credentials or unexpired LPI Master Installer credentials prior to starting installation.
15. Power Quality Specialist: Recognized experts possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction, and able to present unexpired NICET Level 4 credentials with documented experience in power quality testing for installations similar in complexity to this Project.
16. Low-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

    a. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.

17. Medium-Voltage Electrical Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

    a. On-site electrical testing supervisors must have documented certification and experience with testing electrical equipment in accordance with NETA testing standards.

18. Power-Limited Electrical Testing Agency: Entity possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.

    a. On-site power-limited testing supervisor must have BICSI Registered Communications Distribution Designer certification and documented training and experience with testing power-limited equipment in accordance with NETA testing standards.

19. Structural Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing structural concrete, seismic controls, and wind-load controls.
20. Outdoor Pole Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience in accordance with ASTM C1093 for foundation testing and inspections.
21. Luminaire Photometric Testing Laboratory: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" accredited under the NVLAP for Energy Efficient Lighting Products, and complying with applicable IES testing standards.
22. Lighting Testing and Inspecting Agency: Entity possessing active qualifications specified in Section 014000 "Quality Requirements" with documented training and experience with testing and inspecting lighting installations in accordance with IES LM-5.

B. Certifications:

1. Seismic-Load Performance Certificates: Provide special certification for designated seismic systems as indicated in Paragraph 13.2.2 "Special Certification Requirements for Designated Seismic Systems" of [**ASCE/SEI 7-05**] [**ASCE/SEI 7-10**] [**ASCE/SEI 7-16**] for all designated seismic-load systems identified on Drawings or in the Specifications.

a. Include the following information:

1) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4) Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
5) Provide equipment manufacturer's written certification for each designated active electrical seismic device and system, stating that it will remain operable following the design earthquake. Certification must be based on requirements of ASCE/SEI 7, including shake table testing per ICC-ES AC156 or a similar nationally recognized testing standard procedure acceptable to authorities having jurisdiction, or experience data as permitted by ASCE/SEI 7-05 / ASCE/SEI 7-10 / ASCE/SEI 7-16.
6) Provide equipment manufacturer's written certification that components with hazardous contents maintain containment following the design earthquake by methods required in **ASCE/SEI 7-05** / **ASCE/SEI 7-10 / ASCE/SEI 7-16**.
7) Submit evidence demonstrating compliance with these requirements for approval to authorities having jurisdiction after review and acceptance by qualified structural professional engineer.

b. The following systems and components are Designated Seismic Systems and require written special certification of seismic qualification by manufacturer:

1) Equipment, accessories, and components specified in Section 111136 "Vehicle Charging Equipment."
2) Hangers and supports specified in Section 260529 "Hangers and Supports for Electrical Systems."
3) Conduits and their mounting provisions specified in Section 260533.13 "Conduits for Electrical Systems."
4) Boxes and their mounting provisions specified in Section 260533.16 "Boxes and Covers for Electrical Systems."
5) Surface raceways and their mounting provisions specified in Section 260533.23 "Surface Raceways for Electrical Systems."
6) Seismic restraints specified **in Section 260548 "Vibration and Seismic Controls for Electrical Systems."**
7) Cable trays, accessories, and components specified in Section 260536 "Cable Trays for Electrical Systems."
8) Equipment, accessories, and components specified in Section 261116.11 "Secondary Unit Substations with Switchgear Secondary."
9) Equipment, accessories, and components specified in Section 261116.12 "Secondary Unit Substations with Switchboard Secondary."
10) Equipment, accessories, and components specified in Section 261116.13 "Secondary Unit Substations with Motor Control Center Secondary."
11) Equipment, accessories, and components specified in Section 261213 "Liquid-Filled, Medium-Voltage Transformers."
12) Equipment, accessories, and components specified in Section 261216 "Dry-Type, Medium-Voltage Transformers."
13) Equipment, accessories, and components specified in Section 261219 "Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers."
14) Equipment, accessories, and components specified in Section 262213 "Low-Voltage Distribution Transformers."

15) Equipment, accessories, and components specified in Section 262216 "Low-Voltage Buck-Boost Transformers."
16) Equipment, accessories, and components specified in Section 262300 "Low-Voltage Switchgear."
17) Equipment, overcurrent protective devices, accessories, and components specified in Section 262313 "Paralleling Low-Voltage Switchgear."
18) Equipment, accessories, and components specified in Section 262413 "Switchboards."
19) Equipment, accessories, and components specified in Section 262416 "Panelboards."
20) Equipment, accessories, and components specified in Section 262416.16 "Electronically Operated Circuit-Breaker Panelboards."
21) Equipment, accessories, and components specified in Section 262419 "Motor-Control Centers."
22) Equipment, accessories, and components specified in Section 262500 "Low-Voltage Enclosed Bus Assemblies."
23) Cabinets, enclosures, racks, and their mounting provisions specified in Section 262716 "Electrical Cabinets and Enclosures."
24) Equipment, accessories, and components specified in Section 262733 "Power Distribution Units."
25) Equipment, accessories, and components specified in Section 262816 "Enclosed Switches and Circuit Breakers."
26) Equipment, accessories, and components specified in Section 262913.03 "Manual and Magnetic Motor Controllers."
27) Equipment, accessories, and components specified in Section 262913.06 "Soft-Start Motor Controllers."
28) Equipment, accessories, and components specified in Section 262923 "Variable-Frequency Motor Controllers."
29) Equipment, accessories, and components specified in Section 263100 "Photovoltaic Collectors."
30) Equipment, accessories, and components specified in Section 263213.13 "Diesel-Engine-Driven Generator Sets."
31) Equipment, accessories, and components specified in Section 263223.16 "Vertical-Axis Wind Turbines."
32) Equipment, accessories, and components specified in Section 263323.11 "Central Battery Equipment for Emergency Lighting."
33) Equipment, accessories, and components specified in Section 263343 "Battery Chargers."
34) Equipment, accessories, and components specified in Section 263600 "Transfer Switches."
35) Luminaires, accessories, and components specified in Section 265000 "Lighting."

2. Wind-Load Performance Certificates: Provide special certification for systems and components designated on Drawings or in the Specifications to be subject to high wind exposure and impact damage.

   a. Include the following information:

      1) Provide equipment manufacturer's written certification for each designated system and component, stating that it will remain in place and operable following the design wind event and comply with requirements of authorities having jurisdiction.
      2) Certification must be based on ICC-ES or similar nationally recognized testing standard procedures acceptable to authorities having jurisdiction.

1.10 MOCKUPS

A. Simple Mockups for Coordinating Accessibility of Electrical Devices around Fixed Furnishings and Equipment:

1. Build simple mockups using art supplies and other inexpensive materials for verification of general arrangement, actual dimensions, and accessibility of <**Insert identification of room and fabrication**> by [**Architect**] [**Owner**] [**Tenant**] <**Insert approving stakeholders**> prior to fabrication and installation of Work. Depict products from all Divisions requiring coordination including, but not limited to, fixed furnishings, casework, outlet covers and plates, HVAC controls, exposed raceway, exposed plumbing, equipment, and signage.

B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.11 FIELD CONDITIONS

A. Modeling, analysis, product selection, installation, and quality control for Work specified in Division 26 must comply with requirements specified in Section 260011 "Facility Performance Requirements for Electrical."

B. Service Conditions for Electrical Power Equipment: Besides conditions specified in Section 260011 "Facility Performance Requirements for Electrical," specified electrical power equipment must be suitable for operation under service conditions specified as usual service conditions in applicable NEMA PB series, IEEE C37 series, and IEEE C57 series standards, except for the following:

PART 2 - PRODUCTS

2.1 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

A. Substitution requests for electrical equipment will be entertained under the following conditions:

1. Notification of Contractor's intent to request substitutions for convenience must be declared during the Electrical Preconstruction Conference so potential risks to system performance and construction schedule may be identified for Contractor's response in submission of the substitution request. Submission of requests for substitutions for convenience must meet the conditions and deadline specified in Section 012500 "Substitution Procedures" to receive approval.
2. For electrical equipment and systems, substitutions for cause are considered major construction risks. If it is possible that Contractor may need to request substitutions for cause because of equipment unavailability, or inability to meet construction schedule because of lead time, Contractor must declare the possibility during the Electrical Preconstruction Conference to permit establishing a mitigation plan for minimizing risks to system performance and construction schedule.

PART 3 - EXECUTION

3.1 PREPARATION

A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:

1. Submission of power system studies.
2. Submission of specified coordination drawings.
3. Submission of action submittals specified in Division 26.
4. Orders placed for major electrical equipment.
5. Arrival of major electrical equipment on-site.
6. Preinstallation meetings specified in Division 26.
7. Utility service outages.
8. Utility service inspection and activation.
9. Mockup reviews.
10. Closing of walls and ceilings containing electrical Work.
11. System startup, testing, and commissioning activities for major electrical equipment.
12. System startup, testing, and commissioning activities for emergency lighting.
13. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
14. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
15. Requests for special inspections.
16. Requests for inspections by authorities having jurisdiction.

B. Coordination Drawings for Structural Supports: Show coordination of structural supports for equipment and devices, including restraints and bracing for control of seismic and wind loads, with other systems, equipment, and structural supports in the vicinity.

C. Coordination Drawings for Ceiling Areas: Where indicated on Drawings, provide reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment, luminaires, and suspension systems will be attached.
3. Partitions and millwork that penetrate ceiling or extend to within 12 inch (300 mm) of plane of luminaires.
4. Size and location of access panels on ceilings.
5. Elevation, size, and route of sprinkler piping.
6. Elevation, size, and route of plumbing piping.
7. Elevation, size, and route of ductwork.
8. Elevation, size, and route of cable tray.
9. Elevation, size, and route of conduit.
10. Elevation and size of wall-mounted and ceiling-mounted equipment.
11. Moldings.
12. Access panels.
13. Sprinklers.
14. Air inlets and outlets.
15. Control modules.
16. Luminaires.
17. Communications devices.

18. Speakers.
19. Ceiling-mounted projectors.
20. Security devices.
21. Fire-alarm devices.
22. Indicate clear dimensions for maintenance access in front of equipment.
23. Indicate dimensions of fully-open access doors.

D. Coordination Drawings for Cable Tray Routing: Reflected ceiling plan(s), supplemented by sections and other details, drawn to scale, in accordance with Section 013100 "Project Management and Coordination," on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Elevation, size, and route of cable trays.
2. Relationships between components and adjacent structural, electrical, and mechanical elements.
3. Vertical and horizontal offsets and transitions.
4. Elevation and size of sleeves for wall, ceiling, and floor cable penetrations.
5. Elevation of ceilings and size of ceiling tiles.
6. Locations of access panels on ceilings.
7. Locations where cable tray crosses or parallels sprinkler piping.
8. Locations where cable tray crosses plumbing piping.
9. Locations where cable tray crosses or parallels ductwork.
10. Locations of access panels on ductwork.
11. Locations where cable tray crosses conduit.
12. Items blocking access around cable trays, including the following:

    a. Light fixtures.
    b. Speakers.
    c. Fire-alarm devices.
    d. Power outlets.
    e. Wall-mounted equipment.
    f. Equipment racks.
    g. Furniture.
    h. Door swings.
    i. Building features.

13. Indicate clear dimension between cable tray and walls or obstructions that are closer than 10 ft (3 m).
14. Highlight locations where cable tray is greater than 3 ft (1 m) above ceilings. Explain how personnel access will be accommodated for cable tray maintenance.

E. Coordination Drawings for Conduit Routing: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

F. Coordination Drawings for Bus Assembly Routing: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements.
2. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.

3. Clearances for access above and to the side of enclosed bus assemblies.
4. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.
5. Support locations, type of support, and weight on each support.
6. Location of adjacent construction elements including luminaires, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

G. Coordination Drawings for Large Equipment Indoor Installations:

1. Location plan, drawn to scale, showing heavy equipment or truck access paths to loading dock or other freight access into building. Indicate available width and height of doors or openings.
2. Floor plan for entry floor and floor where equipment is located, drawn to scale, showing heavy equipment access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:

    a. Dimensioned concrete bases, outlines of equipment, conduit entries, and grounding equipment locations.
    b. If freight elevator must be used, indicate width and height of door and depth of car. Indicate if large equipment must be tipped to use elevator.
    c. Dimensioned working clearances and dedicated areas below and around electrical equipment where obstructions and tripping hazards are prohibited.

3. Reflected ceiling plans for entry floor and floor where equipment is located, drawn to scale, on which the following items shown and coordinated with each other, based on input from installers of the items involved:

    a. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways, busways, and seismic bracing.
    b. Location of lighting fixtures, sprinkler piping and sprinklers, ducts and diffusers, and other obstructions, indicating available overhead clearance.
    c. Dimensioned working clearances and dedicated areas above and around electrical equipment where foreign systems and equipment are prohibited.

H. Coordination Drawings for Large Equipment Outdoor Installations:

1. Utilities site plan, drawn to scale, showing heavy equipment or truck access paths for maintenance and replacement, with the following items shown and coordinated with each other, based on input from installers of the items involved:

    a. Fences and walls, dimensioned concrete bases, outlines of equipment, conduit entries, and grounding and bonding locations.
    b. Indicate clear dimensions for fence gates and wall openings.
    c. Indicate depth and type of ground cover, and locations of trees, shrubbery, and other obstructions in access path.
    d. Indicate clear height below tree branches, overhead lines, bridges, and other overhead obstructions in access path, or where cranes and hoists will be needed to handle large electrical equipment.
    e. Support locations, type of support, and weight on each support. Locate structural supports for structure-supported raceways.
    f. Dimensioned working clearances and dedicated areas around electrical equipment.

I. Coordination Drawings for Duct Banks:

1. Show duct profiles and coordination with other utilities and underground structures.
2. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

3.2 DELEGATED DESIGN OF STRUCTURAL PENETRATIONS

A. Engage qualified structural professional engineer to design penetrations of structural masonry walls.

B. Delegated Design Drawings for Structural Masonry Wall Penetrations: Where indicated on Drawings, provide reflected ceiling plan(s), supplemented by elevations, sections, and other details, drawn to scale, signed and sealed by a qualified structural professional engineer, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Location and dimensions of structural members supporting wall.
2. Location and dimensions of columns near penetrations.
3. Location and dimension of headers and lintels.
4. Doors and windows near penetrations.
5. Location and dimensions of penetrating cuts.
6. Sprinkler piping and sleeves.
7. Plumbing piping and sleeves.
8. Ductwork and sleeves.
9. Cable tray and sleeves.
10. Conduit and sleeves.
11. Firestopping assemblies for rated penetrations.
12. Structural supports for piping, ductwork, and conduit on both sides of wall.

3.3 INSTALLATION OF ELECTRICAL WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.4 SYSTEM STARTUP

A. Commissioning Activities: per commissioning plan.

3.5 FIELD QUALITY CONTROL

A. Administrant for Medium-Voltage Electrical Tests and Inspections:
   1. Engage qualified medium-voltage electrical testing and inspecting agency to administer and perform tests and inspections.
   2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

B. Administrant for Low-Voltage Electrical Tests and Inspections:
   1. Engage qualified low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.

2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

C. Administrant for Power-Limited Electrical Tests and Inspections:
1. Engage qualified power-limited electrical testing and inspecting agency to administer and perform tests and inspections.
2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

D. Administrant for Structural Tests and Inspections:
1. Engage qualified structural testing and inspecting agency to administer and perform tests and inspections.
2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

E. Administrant for Field Tests and Inspections of Lighting Installations:
1. Engage qualified lighting testing and inspecting agency to administer and perform tests and inspections.
2. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

3.6 CLOSEOUT ACTIVITIES

A. Development of Facility EPM Program

1. Facility EPM Program must be developed by qualified EPM specialist.
2. Conduct Facility EPM Program analysis in accordance with NFPA 70B recommendations.

3. Compile operation and maintenance data from Facility EPM Program analysis and submit updated Facility EPM Program Binders.
4. Organization of Facility EPM Program Binders:

a. Description: Set of binders containing operation and maintenance data for facility's electrical equipment that was compiled during analysis of installed electrical Work for Facility EPM Program development.
b. Referenced Standards: Content must comply with recommendations in NFPA 70B.
c. General Characteristics:

1) Volume 1 - Introduction:

a) Summarize how Facility EPM Program Analysis was performed, how data were collected, and how volumes are organized.
b) Describe Facility EPM Program and provide recommended policies and procedures for implementing the program and keeping it current.
c) Provide place for Owner to identify contact information for employees responsible for implementing and maintaining Facility EPM Program.

2) Volume 2 - Facility Safety, Hazards Awareness, and Emergency Procedures:

a) Include training requirements for employees and contractors.
b) Include list of known facility hazards impacting IT&R activities.
c) Include approval and permitting procedures for IT&R activities.
d) Include incident emergency response procedures.
e) Include emergency shutdown procedures.
f) Include electrical disaster recovery procedures.

3) Volume 3 - Operating Procedures for Electrical Equipment and Controls:

a) Include copies of demonstration and training videos.

4) Volume 4 - Facility Diagrams and Schedules:

a) Include single-line diagrams.
b) Include grounding and bonding diagrams.
c) Include essential wiring diagrams.
d) Include system communications diagrams (WAN, LAN, Wi-Fi, ERCES, MNS, etc.)
e) Include system automation diagrams (SCADA, BMS, lighting, HVAC, etc.).
f) Include records of switchgear, switchboard, and panelboard schedules.
g) Include time-current curves for overcurrent protective devices.
h) Include list of load-current and overload-relay heaters with related motor nameplate data.

5) Volume 5 - Inventory of Facility Equipment Using Electrical Power:

a) Include simplified floor plans showing equipment locations.
b) Identify critical equipment (electrical or otherwise).
c) Include identifying designations and nameplate data.
d) Include warranty and maintenance contract information.

6) Volume 6 - Inventory of Facility Tools, Supplies, and Personnel Protective Equipment:

a) Include schedules of maintenance material items recommended to be stored at facility.
b) Include list of lamp types and photoelectric relays used in facility with ANSI and manufacturers' codes.
c) Include calibration and servicing data for each item.

7) Volume 7 - Inspection, Testing, and Repair (IT&R) Plan:

a) Include tables showing frequency of activities for each item.
b) Include annual schedule with activities mapped to specific days of the year.
c) Include exterior pole inspection and repair procedures.

8) Volume 8 - Inspection, Testing, and Repair (IT&R) Forms:

9) Volume 9 - Inspection, Testing, and Repair (IT&R) Procedures:

10) Volume 10 - Spare Parts List:

a) Include list of all parts required to perform IT&R procedures.
b) Identify quantities of which parts are recommended to be stored on-site.
c) Include source contact information and budget cost for each item.

11) Volume 11 - Construction Project Closeout Record Documentation:

a) Include records of power system studies and photometric studies.
b) Include records of risk assessment studies.
c) Include records of electrical system startup and commissioning activities.
d) Include records of baseline inspections and tests.
e) Include records of baseline infrared photographs with normal light photographs showing the location, direction, angle, and conditions necessary for reproducing each infrared photograph.
f) Include records of baseline settings for adjustable equipment and devices.

5. Format of Facility EPM Program Binders Submittal:

a. Complete Set: On approved online or cloud solution and USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.
b. Volumes 2 and 8: Reproducible hardcopy on archival quality, 28 lb (105 GSM), acid-free, bond paper.

B. Operation and Maintenance Data: Prepare and submit the following:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:

a. <**Insert system, equipment, or device**>.

2. Include the following information:

a. Manufacturer's operating specifications.
b. User's guides for software and hardware.
c. Schedule of maintenance material items recommended to be stored at Project site.
d. Detailed instructions covering operation under both normal and abnormal conditions.
e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
f. List of load-current and overload-relay heaters with related motor nameplate data.
g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
h. Manufacturer's instructions for setting field-adjustable components.
i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.
k. Exterior pole inspection and repair procedures.
l. Include copies of demonstration and training videos.

C. Software and Firmware Operational Documentation: Provide software and firmware operational documentation in Facility EPM Program Binders, including the following:

1. Software operating and upgrade manuals.
2. Names, versions, and website addresses for locations of installed software.
3. Device address list.
4. Printout of software application and graphic screens.
5. Testing and adjusting of panic and emergency power features.
6. For lighting controls, include the following:

    a. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
    b. Operation of adjustable zone controls.

D. Software:

1. Program Software Backup: Provide username and password for approved online or cloud solution and USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.
2. Provide to Owner upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

E. Demonstration: Demonstrate to Owner's maintenance and clerical personnel[**and building occupants**] how to operate the following systems and equipment:

1. Lighting control devices specified in Section 260923 "Lighting Control Devices."
2. Lighting control systems specified in Section 260943.16 "Addressable Luminaire Lighting Controls."
3. Lighting control systems specified in Section 260943.23 "Relay-Based Lighting Controls."
4. Electronic metering and billing software specified in Section 262713 "Electricity Metering."

F. Training: Train Owner's maintenance personnel on the following topics:

1. How to implement Facility EPM Program.
2. How to adjust, operate, and maintain equipment specified in Section 111136 "Vehicle Charging Equipment."
3. How to operate normal and emergency electrical systems, including justifications for, and limitations of, protective device settings recommended in study report specified in Section 260573.16 "Coordination Studies."
4. Electrical power safety fundamentals refresher including arc-flash hazard safety features of electrical power distribution equipment in facility, interpreting arc-flash warning labels, selecting appropriate personal protective equipment, and understanding significance of findings documented in study report specified in Section 260573.19 "Arc-Flash Hazard Analysis."
5. How to adjust, operate, and maintain systems specified in Section 260913 "Electrical Power Monitoring."
6. How to adjust, operate, and maintain devices specified in Section 260923 "Lighting Control Devices."
7. How to adjust, operate, and maintain hardware and software specified in Section 260936 "Modular Dimming Controls, Laptop computer must be used in training.
8. How to adjust, operate, and maintain hardware and software specified in Section 260943.16 "Addressable Luminaire Lighting Controls."
9. How to adjust, operate, and maintain hardware and software specified in Section 260943.23 "Relay-Based Lighting Controls."
10. How to adjust, operate, and maintain equipment specified in Section 261116.11 "Secondary Unit Substations with Switchgear Secondary."

11. How to adjust, operate, and maintain equipment specified in Section 261116.12 "Secondary Unit Substations with Switchboard Secondary."
12. How to adjust, operate, and maintain equipment specified in Section 261116.13 "Secondary Unit Substations with Motor Control Center Secondary."
13. How to adjust, operate, and maintain equipment specified in Section 261213 "Liquid-Filled, Medium-Voltage Transformers."
14. How to adjust, operate, and maintain equipment specified in Section 261216 "Dry-Type, Medium-Voltage Transformers."
15. How to adjust, operate, and maintain equipment specified in Section 261219 "Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers."
16. How to adjust, operate, and maintain equipment specified in Section 261323 "Medium-Voltage Metal-Enclosed Switchgear."
17. How to adjust, operate, and maintain equipment specified in Section 261326 "Medium-Voltage Metal-Clad Switchgear."
18. How to adjust, operate, and maintain equipment specified in Section 261329 "Medium-Voltage Compartmentalized Switchgear."
19. How to adjust, operate, and maintain equipment specified in Section 262300 "Low-Voltage Switchgear."
20. How to adjust, operate, and maintain equipment specified in Section 262313 "Paralleling Low-Voltage Switchgear."
21. How to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories**,** and to use and reprogram microprocessor-based trip, monitoring, and communication units specified in Section 262413 "Switchboards."
22. How to adjust, operate, and maintain control modules specified in Section 262416.16 "Electronically Operated Circuit-Breaker Panelboards."
23. How to adjust, operate, and maintain enclosed controllers specified in Section 262419 "Motor-Control Centers."
24. How to adjust, operate, and maintain hardware and software specified in Section 262713 "Electricity Metering."
25. How to adjust, operate, and maintain equipment specified in Section 262733 "Power Distribution Units."
26. How to adjust, operate, and maintain equipment specified in Section 262913.03 "Manual and Magnetic Motor Controllers."
27. How to adjust, operate, and maintain equipment specified in Section 262913.06 "Soft-Start Motor Controllers."
28. How to adjust, operate, and maintain equipment specified in Section 262923 "Variable-Frequency Motor Controllers."
29. How to adjust, operate, and maintain controllers, remote alarm panels, low-suction-shutdown panels, and to use and reprogram microprocessor-based controls within this equipment specified in Section 262933 "Controllers for Fire Pump Drivers."
30. How to adjust, operate, and maintain equipment specified in Section 263100 "Photovoltaic Collectors."
31. How to adjust, operate, and maintain equipment specified in Section 263213.13 "Diesel-Engine-Driven Generator Sets."
32. How to adjust, operate, and maintain equipment specified in Section 263213.16 "Gas-Engine-Driven Generator Sets."
33. How to adjust, operate, and maintain equipment specified in Section 263213.19 "Bi-Fuel-Engine-Driven Generator Sets."
34. How to adjust, operate, and maintain equipment specified in Section 263323.11 "Central Battery Equipment for Emergency Lighting."
35. How to adjust, operate, and maintain equipment specified in Section 263343 "Battery Chargers."
36. How to adjust, operate, and maintain equipment specified in Section 263353 "Static Uninterruptible Power Supply."
37. How to adjust, operate, and maintain equipment specified in Section 263533 "Power Factor Correction Equipment."

38. How to adjust, operate, and maintain transfer switches and related equipment, including ground-fault protection system, specified in Section 263600 "Transfer Switches."
39. How to adjust, operate, and maintain devices specified in Section 264313 "Surge Protective Devices for Low-Voltage Electrical Power Circuits."
40. How to adjust, operate, and maintain stage lighting equipment specified in Section 265561 "Theatrical Lighting."
41. How to adjust, operate, and maintain luminaire and photoelectric controls specified in Section 265617 "Fluorescent Exterior Lighting."
42. How to adjust, operate, and maintain luminaires and photoelectric controls specified in Section 265619 "LED Exterior Lighting."
43. How to adjust, operate, and maintain luminaires and photoelectric controls specified in Section 265621 "HID Exterior Lighting."

END OF SECTION 260010

SECTION 260011

FACILITY PERFORMANCE REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Field conditions and other facility performance requirements applicable to Work specified in Division 26.

1.2 FIELD CONDITIONS

A. Seismic Hazard Design Loads:

1. Unless otherwise indicated on Contract Documents, specified Work must withstand seismic hazard design loads determined in accordance with requirements specified in this Section, adjusted for installed elevation above or below grade.

a. The term "withstand" means "unit must remain in place without separation of parts from unit when subjected to specified seismic hazard design loads and unit must be fully operational after seismic event."

B. Wind Hazard Design Loads:

1. Perform calculations to obtain force information necessary to properly select wind-load restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in [**ASCE/SEI 7-05**] [**ASCE/SEI 7-10**] [**ASCE/SEI 7-16**] <**Insert ASCE/SEI 7 edition or other wind-load calculation method required by authorities having jurisdiction**>. Where "ASCE/SEI 7" is used throughout this Section, it must be understood that the edition referred to in this subparagraph is intended as referenced throughout the Section Text unless otherwise indicated.

a. Data indicated below that are specific to individual pieces of equipment must be obtained by Contractor and must be included in individual component submittal packages.
b. Coordinate design wind-load calculations with seismic-load calculations for equipment requiring both seismic- and wind-load reinforcement. Comply with requirements in other Sections in addition to those in this Section.

2. Design wind pressure "p" for external sidewall-mounted equipment must be calculated by Delegated Design Contractor using methods in ASCE/SEI 7-16, Ch. 30. Perform calculations according to one of the following, as appropriate:

a. PART 1: Low-Rise Buildings.
b. PART 2: Low-Rise Buildings (Simplified).
c. PART 3: Buildings with "h" less than 60 ft. (18.3 m).
d. PART 4: Buildings with "h" greater than 60 ft. (18.3 m) and less than 160 ft. (48.8 m).

e. PART 5: Open Buildings.

3. Design wind pressure "p" for rooftop equipment must be calculated by Delegated Design Contractor using methods in ASCE/SEI 7-16, Ch. 30, PART 6: Building Appurtenances and Rooftop Structures and Equipment.
   a. Risk Category: [**I**] [**II**] [**III**] [**IV**] [**V**].
   b. Mean Roof Height (h): <**Insert value**>.
   c. Wind Directionality Factor (K_d): <**Insert factor**>.
   d. Exposure Category: [**B**] [**C**] [**D**].
   e. Topographic Factor (K_{zt}): <**Insert factor**>.
   f. Ground Elevation Factor (K_e): <**Insert factor**>.
   g. Velocity Pressure Exposure Coefficient (Evaluated at Height z) (K_z): <**Insert coefficient**>.
   h. Velocity Pressure Exposure Coefficient (Evaluated at Height h) (K_h): <**Insert coefficient**>.
   i. Velocity Pressure at Height z (q_z): Value is calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.
   j. Velocity Pressure at Height h (q_h): Value is calculated by delegated wind-load design Contractor using methods detailed in ASCE/SEI 7-16 Section 26.10.1 or other source approved by authorities having jurisdiction.
      1) Gust-Effect Factor (G): [**0.85**] <**Insert factor**>.
      2) Enclosure Classification: <**Insert classification**>.
      3) Internal Pressure Coefficient (GC_{pi}): <**Insert coefficient**>.
4. Design wind pressure "p" for external sidewall-mounted equipment must be calculated by Delegated Design Contractor using methods in ASCE/SEI 7-10, Ch. 30. Perform calculations according to one of the following, as appropriate:

   a. PART 1: Low-Rise Buildings.
   b. PART 2: Low-Rise Buildings (Simplified).
   c. PART 3: Buildings with "h" greater than 60 ft. (18.3 m).
   d. PART 4: Buildings with "h" less than 160 ft. (48.8 m).
   e. PART 5: Open Buildings.

C. Altitude:

Specify Project's altitude conditions in subparagraph below. Some equipment, such as generators, chillers, or pumps, may require performance derating at high altitude.

1. Sea level to [**1000 ft. (300 m)**] <**Insert elevation**>.

D. Ambient Temperature:

Specify Project's ambient temperature conditions in subparagraph(s) below.

1. <**Insert requirements**>.

E. Temperature Variation: Allow for thermal movements from the following differential temperatures:

Differential values in "Ambient Temperature Differential" and "Material Surface Temperature Differential" subparagraphs below (for aluminum in particular) are suitable for most of the United States.

1. Ambient Temperature Differential: [**120 deg F (67 deg C)**] <**Insert temperature variation**>.

2. Material Surface Temperature Differential: [**180 deg F (100 deg C)**] <**Insert temperature variation**>.
3. Ground Surface Temperature Differential to 10 ft. (3 m) Depth: <**Insert temperature variation**>.

F. Ground Water:

Retain one of two subparagraphs below.

1. Assume ground-water level is at grade level unless a lower water table is noted on Drawings.
2. Assume ground-water level is [**36 inch (900 mm)**] <**Insert dimension**> below ground surface unless a higher water table is indicated on Drawings.

G. Acoustical Performance Conditions:

Specify Project's acoustical conditions in subparagraph(s) below - for example, STC ratings for specific walls or wall types; local noise ordinance requirements; maximum noise requirements for classrooms, conference rooms, or auditoriums; maximum noise requirements for television studios; or requirements to prevent needing employee hearing protection in mechanical equipment rooms.

1. <**Insert requirements**>.

H. Hazardous Material Environmental Conditions:

Specify Project's hazardous material environmental conditions in subparagraph(s) below - for example, automotive service facilities and aircraft hangars may contain specific areas requiring equipment to comply with hazardous (classified) conditions. Indicate specific locations referenced here on Drawings.

1. <**Insert requirements**>.

I. Corrosive Environmental Conditions:

Specify Project's corrosive environmental conditions in subparagraph(s) below - for example, wastewater treatment facilities may have significant concentrations of hydrogen sulfide, which corrodes copper and stainless steel.

1. <**Insert requirements**>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 260011

SECTION 260513

MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cables.
2. Connectors.
3. Solid terminations.
4. Separable insulated connectors.
5. Splice kits.
6. Medium-voltage tapes.
7. Arc-proofing materials.
8. Fault indicators.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

B. Samples: 16 inch lengths for each type of cable specified.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Indicate location of each cable, splice, and termination.

B. Material Certificates: For each type of cable and accessory.

C. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.

D. Source quality-control reports.

E. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 CABLES

A. Acceptable manufacturers:
1. General Cable
2. Okonite
3. Prysmian

B. Cable Type: Type MV 105.

C. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 15 kV.
2. Insulation Thickness: 133 percent insulation level.

D. Conductor: Copper.

E. Comply with UL 1072, AEIC CS8.

F. Conductor Stranding: Compact round, concentric lay, Class B.

G. Shielding: Copper tape, helically applied over semiconducting insulation shield.

H. Cable Jacket: Sunlight-resistant PVC.

2.3 CONNECTORS

A. Acceptable manufacturers:
1. Cooper Power Systems
2. G&W Electric
3. Raychem; TE Connectivity

B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.

C. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.4 SOLID TERMINATIONS

A. Acceptable manufacturers:
1. Cooper Power Systems

2. G&W Electric
3. Raychem; TE Connectivity

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations:

a. Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.

2. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape; cold-shrink-rubber sleeve for end of insulation whether or not supplied with kits.
3. Class 3 Terminations: Kit with stress cone and compression-type connector.

2.5 SPLICE KITS

A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.

B. Acceptable manufacturers:
1. Cooper Power Systems
2. G&W Electric
3. Raychem; TE Connectivity

C. Standard: Comply with IEEE 404.

D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Premolded, cold-shrink-rubber, in-line splicing kit.

2.6 MEDIUM-VOLTAGE TAPES

A. Description: Electrical grade, insulating tape rated for medium voltage application.

B. Acceptable manufacturers:
1. Cooper Power Systems
2. G&W Electric
3. Raychem; TE Connectivity

C. Ethylene/propylene rubber-based, 30 mil splicing tape, rated for 130 deg C operation. Minimum 3/4 inch wide.

D. Silicone rubber-based, 12 mil self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inch wide.

E. Insulating-putty, 125 mil elastic filler tape. Minimum 1-1/2 inch wide.

2.7 ARC-PROOFING MATERIALS

A. Description: Fire retardant, providing arc flash protection.

B. Acceptable manufacturers:
1. Cooper Power Systems
2. G&W Electric
3. Raychem; TE Connectivity

C. Tape for First Course on Metal Objects: 10 mil thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

D. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, and compatible with cable jacket.

E. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch wide.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inch on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

E.

F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

G. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

H. Install cable splices at pull points and elsewhere as indicated; use standard kits.

I. Install terminations at ends of conductors.

J. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.
2. Wrap metallic cable components with 10 mil pipe-wrapping tape.
3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1 inch wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

K. Ground shields of shielded cable at terminations and splices.. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

L. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

M. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.

B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 260513

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Metal-clad cable, Type MC.
3. Armored cable, Type AC.
4. Photovoltaic cable, Type PV.
5. Mineral-insulated cable, Type MI.
6. Tray cable, Type TC.
7. Fire-alarm wire and cable.
8. Connectors and splices.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35 000 V.
4. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
5. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
6. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Nonmetallic underground conduit with conductors, Type NUCC.
3. Metal-clad cable, Type MC.
4. Armored cable, Type AC.
5. Photovoltaic cable, Type PV.
6. Mineral-insulated cable, Type MI.
7. Tray cable, Type TC.
8. Fire-alarm wire and cable.
9. Connectors and splices.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Wire; brand of Belden, Inc.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable; Prysmian Group North America.
5. Okonite Company (The).
6. Southwire Company, LLC.

B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 and ASTM B496 for stranded conductors.

E. Conductor Insulation:

1. Type RHH and Type RHW-2. Comply with UL 44.
2. Type TC-ER. Comply with NEMA WC 70/ICEA S-95-658 and UL 1277.
3. Type THHN and Type THWN-2. Comply with UL 83.
4. Type XHHW-2. Comply with UL 44

F. Shield:

1. Type TC-ER: Cable designed for use with ASDs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire. and sunlight- and oil-resistant outer PVC jacket.

2.2 METAL-CLAD CABLE, TYPE MC

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company
2. Cerro Wire Company
3. Southwire Company

B. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2. Comply with UL 83.
2. Type XHHW-2. Comply with UL 44.

H. Armor: Steel or Aluminum, interlocked.

I. Jacket: PVC applied over armor.

2.3 PHOTOVOLTAIC CABLE, TYPE PV

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. General Cable; Prysmian Group North America.
3. Service Wire Co.
4. Southwire Company, LLC.

B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated [**2000**] [**600**] V.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation: Comply with UL 44 and UL 4703.

2.4 MINERAL-INSULATED CABLE, TYPE MI

A. Subject to compliance with requirements, provide products by one of the following:
1. Pyrotenax Company
2. Omega Company
3. ARI Company

B. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600 V or less.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. UL 2196 for fire resistance.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper.

E. Insulation: Compressed magnesium oxide.

F. Sheath: Copper.

2.5 TRAY CABLE, TYP

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. Alpha Wire; brand of Belden, Inc.
2. Belden Inc.
3. Encore Wire Corporation.
4. General Cable; Prysmian Group North America.
5. Okonite Company (The).
6. Southwire Company, LLC.
7. WESCO.

B. Description: A factory assembly of insulated current-carrying conuctors with or without an equipment grounding conductor in a nonmetallic jacket.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1277.

3. Comply with ICEA S-73-532/NEMA WC 57 for Type TC cables used for control, thermocouple extension, and instrumentation.
4. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
5. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Ground Conductor: Bare.

F. Conductor Insulation: Type XHHW-2. Comply with UL 44.

G. Shield: Metallic.

2.6 FIRE-ALARM WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. <Insert manufacturer's name>.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor **with outer jacket** with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.7 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M Electrical Products.
2. ABB, Electrification Business.
3. AFC Cable Systems; Atkore International.
4. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
5. Gardner Bender.
6. Hubbell Utility Solutions; Hubbell Incorporated.
7. ILSCO.
8. Ideal Industries, Inc.
9. NSi Industries LLC.
10. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

11. Service Wire Co.
12. TE Connectivity Ltd.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper or Bronze as appropriate.
2. Type: Two hole with long barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4

B. Branch Circuits:

1. Copper:

a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

E. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors in raceway**] [**Type USE, single conductor in raceway**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Multiconductor cable, Type SE**].

B. Exposed Feeders: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: [**Type THHN/THWN-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors in raceway**] [**Underground feeder cable, Type UF**].

E. Feeders Installed below Raised Flooring: [**Type THHN/THWN-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**].

F. Feeders in Cable Tray: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors larger than No. 1/0 AWG**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

G. Exposed Branch Circuits, Including in Crawlspaces: [**Type THHN/THWN-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: [**Type THHN/THWN-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors in raceway**] [**Underground branch-circuit cable, Type UF**].

J. Branch Circuits Installed below Raised Flooring: [**Type THHN/THWN-2, single conductors in raceway**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**].

K. Branch Circuits in Cable Tray: [**Type THHN/THWN-2, single conductors in raceway**] [**Type XHHW-2, single conductors larger than No. 1/0 AWG**] [**Armored cable, Type AC**] [**Metal-clad cable, Type MC**] [**Mineral-insulated, metal-sheathed cable, Type MI**] [**Nonmetallic-sheathed cable, Type NM**].

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

M. ASD Output Circuits: [**Type XHHW-2 in metal conduit**] [**Type TC-ER cable with braided shield**] [**Type TC-ER cable with dual tape shield**].

N. PV Circuits, Type USE-2: For PV source circuits rated at 600 V or less.

O. PV Circuits, Type PV: For PV source circuits rated at [**600**] [**1000**] [**2000**] V.

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points in accordance with Section 260533.13 "Conduits for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."

1. Install plenum cable in environmental airspaces, including plenum ceilings.
2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system must be installed in a dedicated pathway system.

    a. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

3. Fire-Rated Cables: Use of two-hour, fire-rated fire-alarm cables, NFPA 70, Types MI and CI, is[**not**] permitted.
4. Signaling Line Circuits: Power-limited fire-alarm cables [**may**] [**must not**] be installed in the same cable or pathway as signaling line circuits.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

F. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

G. Wiring to Remote Alarm Transmitting Device: 1 inch (25 mm) conduit between the fire-alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material[**and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors**].

C. Wiring at Outlets: Install conductor at each outlet, with at least [**6 inch (150 mm)**] [**12 inch (300 mm)**] of slack.

D. Comply with requirements in [**Section 284621.11 "Addressable Fire-Alarm Systems"**] [**Section 284621.13 "Conventional Fire-Alarm Systems"**] for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test [**service entrance and feeder conductors**] [**and**] [**conductors**] feeding the following critical equipment and services for compliance with requirements:

    a. <**Insert, in separate subparagraphs, critical equipment and services to be tested**>.

3. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

Consider the cost and benefit of infrared scanning of cable and conductor splices before retaining "Initial Infrared Scanning" Subparagraph below.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

Retain "Follow-up Infrared Scanning" Subparagraph below, unless Owner will do follow-up scanning or if Project does not warrant such scanning.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backboards.
2. Category 5e balanced twisted pair cable.
3. Category 6 balanced twisted pair cable.
4. Category 6a balanced twisted pair cable.
5. Balanced twisted pair cable hardware.
6. Twin-axial data highway cable.
7. RS-232 cable.
8. RS-485 cable.
9. Control cable.
10. Control-circuit conductors.
11. Fire-alarm wire and cable.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Backboards.
2. Category 5e balanced twisted pair cable.
3. Category 6 balanced twisted pair cable.
4. Category 6a balanced twisted pair cable.
5. Balanced twisted pair cable hardware.
6. Twin-axial data highway cable.
7. RS-232 cable.
8. RS-485 cable.
9. Control cable.
10. Control-circuit conductors.
11. Fire-alarm wire and cable.

B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for lead content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inch (1520 mm) or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inch (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

B. Painting: Paint plywood on all sides and edges with flat eggshell latex paint. Comply with requirements in Section 099123 "Interior Painting."

2.3 CATEGORY 5e BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Belden Inc.
3. Berk-Tek, a Leviton Company.
4. CommScope, Inc.
5. General Cable; Prysmian Group North America.
6. Mohawk; a division of Belden Networking, Inc.
7. West Penn Wire; brand of Belden, Inc.

C. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

D. Conductors: 100 ohm, No. 24 AWG solid copper.

E. Shielding/Screening: Shielded twisted pairs (FTP).

F. Cable Rating: Plenum.

G. Jacket: White or Gray thermoplastic.

2.4 CATEGORY 6 BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable,[**with internal spline,**] certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Belden Inc.
4. Berk-Tek, a Leviton Company.
5. CommScope, Inc.
6. General Cable; Prysmian Group North America.
7. Mohawk; a division of Belden Networking, Inc.

C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

D. Conductors: 100 ohm, No. 23 AWG solid copper.

E. Shielding/Screening: Shielded twisted pairs.

F. Cable Rating: Plenum.

G. Jacket: [White] [Gray] [Blue] [Yellow] thermoplastic.

2.5 CATEGORY 6a BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500 MHz.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. Belden Inc.
4. Berk-Tek, a Leviton Company.
5. CommScope, Inc.
6. General Cable; Prysmian Group North America.
7. Mohawk; a division of Belden Networking, Inc.

C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

D. Conductors: 100 ohm, No. 23 AWG solid copper.

E. Shielding/Screening: Shielded twisted pairs (FTP).

F. Cable Rating: Plenum.

G. Jacket: [White] [Gray] [Blue] [Yellow] thermoplastic.

2.6 BALANCED TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. AMP NETCONNECT; a TE Connectivity Ltd. company.
3. American Technology Systems Industries, Inc.
4. Belden Inc.
5. Berk-Tek, a Leviton Company.
6. CommScope, Inc.
7. General Cable; Prysmian Group North America.
8. Molex Premise Networks.
9. Panduit Corp.

C. General Requirements for Balanced Twisted Pair Cable Hardware:

1. Comply with the performance requirements of [**Category 5e**] [**Category 6**] [**Category 6a**] [**Category 7**].
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables must be terminated with connecting hardware of same category or higher.

D. Source Limitations: [**Obtain balanced twisted pair cable hardware from single source from single manufacturer**] [**Obtain balanced twisted pair cable hardware from same manufacturer as balanced twisted pair cable, from single source**].

E. Connecting Blocks: [**110-style IDC for Category 5e**] [**110-style IDC for Category 6**] [**66-style IDC for Category 5e**]. Provide blocks for the number of cables terminated on the block, plus [**25**] <**Insert number**> percent spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: **One** for each conductor in assigned cables.

G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 or 48 ports.

2. Construction: 16-gauge steel and mountable on 19 inch (483 mm) equipment racks.

Coordinate "Number of Jacks per Field" Subparagraph below with Drawings for quantity of fields.

3. Number of Jacks per Field: One for each four-pair [**cable indicated**] [**conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria**].

Cords are generally available in lengths of up to 20 ft. (6 m) and longer in 24 inch (600 mm) increments.

H. Patch Cords: Factory-made, four-pair cables in [**36 inch (900 mm)**] [**48 inch (1200 mm)**] <**Insert length**>lengths; terminated with an eight-position modular plug at each end.

Retain one of two subparagraphs below. Retain first for Category 6 or Category 6a; retain second for Category 5e patch cords.

1. Patch cords must have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords must have latch guards to protect against snagging.
2. Patch cords must have color-coded boots for circuit identification.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.

Requirement below is optional in TIA-568-C.1.

3. Marked to indicate transmission performance.

J. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100 ohm unshielded or shielded balanced twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standards:

a. Category 5e, unshielded balanced twisted pair cable must comply with IEC 60603-7-2.
b. Category 5e, shielded balanced twisted pair cable must comply with IEC 60603-7-3.
c. Category 6, unshielded balanced twisted pair cable must comply with IEC 60603-7-4.
d. Category 6, shielded balanced twisted pair cable must comply with IEC 60603-7.5.
e. Category 6a, unshielded balanced twisted pair cable must comply with IEC 60603-7-41.
f. Category 6a, shielded balanced twisted pair cable must comply with IEC 60603-7.51.

4. Marked to indicate transmission performance.

Coordinate "Faceplate" Paragraph below with other items specified to be mounted in workstation faceplates. Revise paragraph if faceplate elevations are on Drawings.

K. Faceplate:

1. [**Two**] [**Four**] [**Six**] port, vertical single-gang faceplates designed to mount to single-gang wall boxes.
2. [**Eight**] [**10**] [**12**] port, vertical double-gang faceplates designed to mount to double-gang wall boxes.

Retain "Plastic Faceplate" or "Metal Faceplate" Subparagraph below, or retain both as required to match Section 260533.16 "Boxes and Covers for Electrical Systems."

3. Plastic Faceplate: High-impact plastic. Coordinate color with Section 260533.16 "Boxes and Covers for Electrical Systems."
4. Metal Faceplate: [**Stainless steel**] [**Brass**] <**Insert description**>, complying with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems."
5. For use with snap-in jacks accommodating any combination of balanced twisted pair, optical fiber, and coaxial work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

L. Legend:

1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.7 TWIN-AXIAL DATA HIGHWAY CABLE

A. Standard Cable: NFPA 70, Type CM.

Retain one wire size with the corresponding stranding configuration option in first subparagraph below.

1. Paired, <**Insert number**> pairs, [**No. 20**] [**No. 22**] [**No. 24**] AWG, stranded [**(7x28)**] [**(7x30)**] [**(7x32)**] tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

Retain one wire size with the corresponding stranding configuration option in first subparagraph below.

1. Paired, <**Insert number**> pairs, [**No. 20**] [**No. 22**] [**No. 24**] AWG, stranded [**(7x28)**] [**(7x30)**] [**(7x32)**] tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.

NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.

6. Flame Resistance: Comply with NFPA 262.

2.8 RS-232 CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Wire & Cable Inc.
2. Belden Inc.
3. General Cable; Prysmian Group North America.
4. Genesis; Resideo Technologies, Inc.
5. Southwire Company, LLC.

RS-232 communications require three to nine conductors with an overall shield. Circuit is limited to a distance of not more than 50 ft. (15 m). Add other conductor count cables as needed for Project.

B. PVC-Jacketed, TIA 232-F:

1. [**Three**] [**Nine**], No. 22 AWG, stranded (7x30) tinned copper conductors.
2. <Double click to insert sustainable design text for lead content.>
3. Polypropylene insulation.
4. Aluminum foil-polyester tape shield with 100 percent shield coverage.
5. PVC jacket.
6. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
7. NFPA 70 Type: Type CM.
8. Flame Resistance: Comply with UL 1581.

C. Plenum-Type, TIA 232-F:

1. [**Three**] [**Nine**], No. 22 AWG, stranded (7x30) tinned copper conductors.
2. <Double click to insert sustainable design text for lead content.>
3. PE insulation.
4. Aluminum foil-polyester tape shield with 100 percent shield coverage.
5. Fluorinated ethylene propylene jacket.
6. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
7. Flame Resistance: Comply with NFPA 262.

2.9 RS-485 CABLE

RS-485 communications require a single twisted pair for half-duplex communications. Some manufacturers use two twisted pairs to provide full duplex. See manufacturer's data to determine the wiring requirements. Circuit is limited to a distance of not more than 4000 ft. (1220 m).

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, [**one pair**] [**two pairs**], twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.

5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, [**one pair**] [**two pairs**], No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket..
5. Flame Resistance: NFPA 262.

2.10 CONTROL CABLE

Retain "Paired Cable" or "Plenum-Rated, Paired Cable" Paragraph below, or both. Other conductor sizes, configurations, and insulation types are available.

A. Paired Cable: NFPA 70, Type CMG.

1. [**One**][**Multi-**]pair, twisted, [**No. 16 AWG, stranded (19x29)**] [**No. 18 AWG, stranded (19x30)**] tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. [**One**][**Multi-**]pair, twisted, [**No. 16 AWG, stranded (19x29)**] [**No. 18 AWG, stranded (19x30)**] tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.11 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

1. Encore Wire Corporation.
2. General Cable; Prysmian Group North America.
3. Service Wire Co.
4. Southwire Company, LLC.

B. Class 1 Control Circuits: Stranded copper, [**Type THHN/THWN-2, complying with UL 83 in raceway**] [**Type THW, complying with UL 83 in raceway**] [**Type XHHW-2, complying with UL 44 in raceway**] [**Type TC, complying with UL 1277 in raceway**] [**Type MC, complying with UL 1569**].

C. Class 2 Control Circuits: Stranded copper, [**Type THHN/THWN-2, complying with UL 83 in raceway**] [**Type XHHW-2, complying with UL 44 in raceway**] [**power-limited cable, concealed in building finishes**] [**power-limited tray cable, in cable tray**].

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, [**Type THHN/THWN-2, complying with UL 83 in raceway**] [**Type XHHW-2, complying with UL 44 in raceway**] [**power-limited cable, concealed in building finishes**] [**power-limited tray cable, in cable tray**] [**Type TW or Type TF, complying with UL 83, in raceway**].

E. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

FIRE-ALARM WIRE AND CABLE

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Allied Wire & Cable Inc.
2. CommScope, Inc.
3. Comtran Corporation.
4. Genesis; Resideo Technologies, Inc.
5. Prysmian Cables and Systems; Prysmian Group North America.
6. Radix Wire.
7. Rockbestos-Suprenant Cable Corp.
8. Superior Essex Inc.; subsidiary of LS Corp.
9. West Penn Wire; brand of Belden, Inc.

G. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

H. Signaling Line Circuits: Twisted, shielded pair, **size as recommended by system manufacturer**.

Retain "Circuit Integrity Cable" Subparagraph below if use of cable is an option.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

I. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Control-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Low-Voltage Circuits: No. 12 AWG, minimum, in pathway.

Retain "Multiconductor Armored Cable" Subparagraph below if use of cable is an option.

3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor[**with outer jacket**] with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to evaluate cables.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for raceway selection and installation requirements for conduits as supplemented or modified in this Section.

B. Comply with requirements in Section 260533.23 "Surface Raceways for Electrical Systems" for raceway selection and installation requirements for wireways as supplemented or modified in this Section.

C. Comply with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems" for raceway selection and installation requirements for boxes as supplemented or modified in this Section.

Retain one of first two subparagraphs below.

1. Outlet boxes must be no smaller than 2 inch (50 mm) wide, 3 inch (75 mm) high, and 2-1/2 inch (64 mm) deep.
2. Outlet boxes for cables must be no smaller than 4 inch (102 mm) square by [**1-1/2 inch (38 mm)**] [**2-1/8 inch (53 mm)**] deep with extension ring sized to bring edge of ring to within 1/8 inch (3.1 mm) of the finished wall surface.
3. Flexible metal conduit must not be used.

D. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

E. Install manufactured conduit sweeps and long-radius elbows if possible.

F. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits [**3 inch (75 mm)**] <**Insert dimension**> above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96 inch (2440 mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inch (760 mm) and not more than 6 inch (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271513 "Communications Copper Horizontal Cabling" unless otherwise indicated.
3. Do not untwist balanced twisted pair cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inch (200 mm) above ceilings by cable supports not more than [**30 inch (760 mm)**] <**Insert dimension**> apart.

3. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of [**72 inch (1830 mm)**] <**Insert dimension**> of cable in a coil not less than [**12 inch (305 mm)**] <**Insert dimension**> in diameter.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment must be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch (127 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch (305 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch (64 mm).
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch (150 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch (305 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:

   a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch (75 mm).
   c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inch (127 mm).

3.4 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; [**No 14 AWG**] <**Insert wire size**>.
2. Class 2 low-energy, remote-control, and signal circuits; [**No. 16 AWG**] <**Insert wire size**>.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; [**No 12 AWG**] <**Insert wire size**>.

3.6 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.

    a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding hubs.
5. Grounding and bonding connectors.
6. Intersystem bonding bridge grounding connector.
7. Grounding and bonding busbars.
8. Signal reference grids.
9. Grounding (earthing) electrodes.
10. Grounding electrode enclosures.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 264113 "Lightning Protection for Structures" specifies bonding of lightning protection grounding electrodes to facility grounding electrodes.
4. Section 270528 "Pathways for Communications Systems" specifies additional requirements for grounding and bonding of communications raceways, boxes, and cable trays.
5. Section 271100 "Communications Equipment Room Fittings" specifies additional requirements for grounding and bonding of communications equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Product Data:

C. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control for Grounding and Bonding of Electrical Power" Article, including the following:

1. Grounding electrode access enclosures.
2. Grounding electrodes.
3. Grounding arrangements and connections for separately derived systems.
4. <**Insert items**>.

D. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

Submittals for record documents, operation and maintenance data, software, and software documentation are specified in Section 260010 "Supplemental Requirements for Electrical."

Retain "Operation and Maintenance Data" Paragraph below if specifying test wells, separately derived systems, or ring electrode or other grounding for sensitive electronic equipment.

A. Operation and Maintenance Data:

1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:

Coordinate first subparagraph below with "Shop Drawings" Paragraph in "Action Submittals" Article. Section 017823 "Operation and Maintenance Data" and Section 017839 "Project Record Documents" require submittals to be included in those documents for use by maintenance forces throughout life of Project.

a. Plans showing locations of grounding features described in "Field Quality Control for Grounding and Bonding of Electrical Power" Article, including the following:

1) Grounding electrode access enclosures.
2) Grounding electrodes.
3) Grounding arrangements and connections for separately derived systems.
4) <**Insert items**>.

Retain subparagraph below for projects requiring high reliability for electrical systems. NETA MTS provides more easily interpreted recommendations for frequency of tests and inspections than NFPA 70B.

b. Instructions for periodic testing and inspection of grounding features at [**test wells**] [**ring electrodes**] [**grounding connections for separately derived systems**] <**Insert locations**> based on [**NETA MTS**] [**NFPA 70B**] <**Insert reference**>.

1) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
2) Include recommended testing intervals.

PART 2 - PRODUCTS

Manufacturers and products listed in this Section are neither recommended nor endorsed by the AIA or Deltek. Before selecting manufacturers and products, verify availability, suitability for intended applications, and compliance with minimum performance requirements. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, **THHN/THWN-2 or THWN-2**, **copper or tinned-copper** wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Isolated Equipment Grounding Conductor:

1. General Characteristics: 600 V, **THHN/THWN-2 or THWN-2**, **copper or tinned-copper** wire or cable, green color with one or more yellow stripes, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. ASTM - Bare Copper Grounding and Bonding Conductor:

1. Manufacturers: Subject to compliance with requirements, **available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**:

a. ERICO; brand of nVent Electrical plc.
b. Harger Lightning & Grounding; business of Harger, Inc.

2. Referenced Standards: Complying with one or more of the following:

a. Soft or Annealed Copper Wire: ASTM B3.
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

D. UL KDER - Armored Grounding Wire:

1. Description: Single corrosion-resistant copper, aluminum, or copper-clad aluminum conductor within helically formed steel armor.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. LS Cable & System USA; subsidiary of LS Corp.
b. Southwire Company, LLC.
c. Superior Essex Inc.; subsidiary of LS Corp.
d. Viakon; brand of Conductores Monterrey S.A. de C.V.; a subsidiary of Xignux.

3. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

4. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

E. UL KDSH - Protector Grounding Conductor:

1. Description: Conductors intended to be used for grounding primary protector or metallic members of cable sheath in accordance with Chapters 7 and 8 of NFPA 70.

2. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Superior Essex Inc.; subsidiary of LS Corp.

3. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

4. Listing Criteria:

    a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

5. Options:

    a. Color: green.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
    b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

3. Sustainability Characteristics:

D. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Cooper B-line; brand of Eaton, Electrical Sector.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. ERICO; brand of nVent Electrical plc.

e. Galvan Industries, Inc.; Electrical Products Division, LLC.
f. Harger Lightning & Grounding; business of Harger, Inc.
g. ILSCO.
h. Panduit Corp.
i. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
j. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics:

a. Two pieces with **stainless steel** bolts.
b. Clamp Material: **Brass** or **Tinned brass**.
c. Listed for outdoor use.

E. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Arlington Industries, Inc.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. ERICO; brand of nVent Electrical plc.
f. Galvan Industries, Inc.; Electrical Products Division, LLC.
g. Greaves Corp.; Essex Products Group, Inc.
h. Harger Lightning & Grounding; business of Harger, Inc.
i. ILSCO.
j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
k. Panduit Corp.
l. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics:

a. Clamp Material: **Brass** or **Tinned brass**.
b. Listed for outdoor use.

F. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
b. Crouse-Hinds; brand of Eaton, Electrical Sector.
c. ERICO; brand of nVent Electrical plc.
d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
e. Panduit Corp.

2. General Characteristics:

a. Clamp Material: **Copper**, **Tinned copper** or **Galvanized steel**.
b. Listed for outdoor use.

G. UL KDER - Beam Grounding and Bonding Clamp:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Anderson; brand of Hubbell Utility Solutions; Hubbell Incorporated.
c. Panduit Corp.
d. Penn-Union Corp.; subsidiary of Nesco, Inc.
e. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Mechanical-type, terminal, ground wire access from four directions; with dual, tin-plated or silicon bronze bolts.

H. UL KDER - Exothermically Welded Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. ERICO; brand of nVent Electrical plc.
e. Harger Lightning & Grounding; business of Harger, Inc.
f. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Bonding Bushing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Arlington Industries, Inc.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Threaded bushing with insulated throat.

E. UL KDER - Grounding Bushing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Arlington Industries, Inc.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.4 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

    a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Grounding and Bonding Hub <**Insert drawing designation**>:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Arlington Industries, Inc.
c. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Greaves Corp.; Essex Products Group, Inc.
f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
g. Penn-Union Corp.; subsidiary of Nesco, Inc.

2. General Characteristics: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.5 GROUNDING AND BONDING CONNECTORS

A. Source Limitations: Obtain products from single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

C. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Copper or copper alloy, for compression bonding of one or more conductor directly to copper busbar. Listed for direct burial.

D. UL KDER - Lay-In Lug Mechanical-Type Grounding and Bonding Busbar Terminal:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Chatsworth Products, Inc.
c. Greaves Corp.; Essex Products Group, Inc.
d. ILSCO.
e. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Mechanical-type, **copper rated for direct burial** terminal with set screw.

E. UL KDER - Crimped Lug Pressure-Type Grounding and Bonding Busbar Terminal:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ABB, Electrification Business.
   b. Harger Lightning & Grounding; business of Harger, Inc.
   c. ILSCO.
   d. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Cast silicon bronze, solderless compression-type wire terminals; with long barrel and two holes spaced on 5/8 or 1 inch (16 or 25 mm) centers for two-bolt connection to busbar.

F. UL KDER - Split-Bolt Service-Post Pressure-Type Grounding and Bonding Busbar Terminal:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Panduit Corp.
   b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Bolts that surround cable and bond to cable under compression when nut is tightened after assembly is screwed into busbar opening.

G. UL KDER - Crimped Pressure-Type Grounding and Bonding Cable Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ABB, Electrification Business.
   b. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
   c. ILSCO.

2. General Characteristics: Crimp-and-compress connectors that bond to conductor when connector is compressed around conductor.

   a. **Copper**, **Tinned copper**, C and H shaped.

H. UL KDER - Split-Bolt Pressure-Type Grounding and Bonding Cable Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ABB, Electrification Business.
   b. ERICO; brand of nVent Electrical plc.
   c. Greaves Corp.; Essex Products Group, Inc.
   d. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Bolts that surround cable and bond to cable under compression when nut is tightened.

    a. **Copper** or **Tinned copper**.

2.6 INTERSYSTEM BONDING BRIDGE GROUNDING CONNECTORS

A. Description: Devices that provide means for connecting communications systems grounding and bonding conductors at service equipment or at disconnecting means for buildings or structures.

B. Performance Criteria:

1. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

    a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

C. UL KDSH - One-Piece Intersystem Bonding Bridge Grounding Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Galvan Industries, Inc.; Electrical Products Division, LLC.
    b. Madison Electric Products; business of Southwire Company, LLC.

2. General Characteristics: Zinc-alloy one-piece construction; six terminating points; gangable.

D. UL KDSH - Two-Piece Intersystem Bonding Bridge Grounding Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    b. Crouse-Hinds; brand of Eaton, Electrical Sector.
    c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: **Copper** body and polycarbonate cover; four terminating points.

2.7 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding devices that serve as common connection for multiple grounding and bonding conductors.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

3. Sustainability Characteristics:

D. UL KDER - Equipment Room Grounding and Bonding Busbar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Chatsworth Products, Inc.
b. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. ERICO; brand of nVent Electrical plc.
e. Harger Lightning & Grounding; business of Harger, Inc.
f. Hoffman; brand of nVent Electrical plc.
g. ILSCO.
h. Panduit Corp.
i. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics:

a. Bus: Rectangular bar of annealed copper.
b. Mounting Stand-Off Insulators: Lexan or PVC.

1) Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.

3. Options:

a. Dimensions: [**1/4 by 4 inch (6.3 by 100 mm)**] in cross section; length as indicated on Drawings.
b. Predrilled Hole Pattern: **Complying with BICSI N3 and TIA-607 9/32 inch (7.14 mm) holes spaced 1-1/8 inch (28 mm) apart Suitable for installing specified grounding and bonding connectors**.
c. Mounting Hardware: Stand-off brackets that provide **4 inch (100 mm)** clearance to access rear of bus. Brackets and bolts must be stainless steel.

E. UL KDER - Rack and Cabinet Bonding Busbar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Chatsworth Products, Inc.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Harger Lightning & Grounding; business of Harger, Inc.
d. Hoffman; brand of nVent Electrical plc.
e. Panduit Corp.

2. General Characteristics:

a. Bus: Rectangular bar of hard-drawn solid copper.
b. Horizontal Mounting Dimensions: Designed for mounting in [**9 inch (483 mm)**] or **23 inch (584 mm)** wide equipment racks or cabinets as required.
c. Vertical Mounting Dimensions: Designed for mounting in **72 inch (1827 mm)** or **36 inch (914 mm)** high equipment racks or cabinets as required.
d. Predrilled Hole Pattern: Accepts connectors for grounding and bonding conductor sizes 14 AWG to 2/0 AWG.
e. Mounting Hardware: Stainless steel or copper-plated, for attachment to rack.

2.8 GROUNDING (EARTHING) ELECTRODES

A. Source Limitations: Obtain products from single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

C. UL KDER - Rod Electrode:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Continental Industries; brand of Hubbell Utility Solutions; Hubbell Incorporated.
c. ERICO; brand of nVent Electrical plc.
d. Galvan Industries, Inc.; Electrical Products Division, LLC.
e. Harger Lightning & Grounding; business of Harger, Inc.
f. allG Fabrication (formerly ALT).

2. General Characteristics: Copper-clad 3/4 inch by 10 ft.

D. UL KDER - Chemically Charged Rod Electrode:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ALLTEC LLC.
b. ERICO; brand of nVent Electrical plc.
c. allG Fabrication (formerly ALT).
d. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. General Characteristics: Copper tube, straight or L-shaped, charged with **nonhazardous electrolytic chemical salts**.

a. Termination: Factory-attached 4/0 AWG bare conductor at least 48 inch (1200 mm) long.
b. Backfill Material: Electrode manufacturer's recommended material.

2.9 GROUNDING ELECTRODE ENCLOSURES

A. Description: Enclosures designed to protect grounding electrodes from damage while providing access for inspection and testing of the grounding system.

B. Grounding Electrode Access Well Enclosure:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ERICO; brand of nVent Electrical plc.
b. Harger Lightning & Grounding; business of Harger, Inc.
c. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.

2. Source Limitations: Obtain products from single manufacturer.
3. Product Characteristics:

a. Well Material: **Concrete** or **HDPE**.
b. Cover Material: **Cast iron**, **Concrete**, **HDPE** or **Steel**.
c. Cover Strength: **Driveway use**.

4. Required Product Options:

a. Round:

1) Nominal Diameter: [**8 inch (200 mm)**] [**9 inch (230 mm)**] [**10 inch (250 mm)**] [**12 inch (300 mm)**] [**13 inch (330 mm)**] <**Insert dimension**>.
2) Nominal Height: [**10 inch (250 mm)**] [**12 inch (300 mm)**] [**18 inch (450 mm)**] [**24 inch (600 mm)**] [**30 inch (760 mm)**] [**36 inch (910 mm)**] [**48 inch (1220 mm)**] <**Insert dimension**>.
3) Slotted sides for installation after grounding connections made.

b. Rectangular:

1) Nominal Width: [**2 inch (50 mm)**] [**12 inch (300 mm)**] [**13 inch (330 mm)**] [**17 inch (430 mm)**] [**36 inch (910 mm)**] <**Insert dimension**>.
2) Nominal Length: [**10 inch (250 mm)**] [**12 inch (300 mm)**] [**13 inch (330 mm)**] [**17 inch (430 mm)**] [**18 inch (450 mm)**] [**24 inch (600 mm)**] [**36 inch (910 mm)**] [**42 inch (1070 mm)**] <**Insert dimension**>.
3) Nominal Height: [**12 inch (300 mm)**] [**18 inch (450 mm)**] [**24 inch (600 mm)**] [**30 inch (760 mm)**] <**Insert dimension**>.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

A. Grounding and Bonding Conductors:

1. Provide solid conductor for **8 AWG** and smaller, and stranded conductors for **6 AWG** and larger unless otherwise indicated.
2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Underground Grounding Conductors: Install bare **tinned-**copper conductor, **2/0 AWG** minimum.

B. Grounding and Bonding Connectors:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on Drawings.

3.3 SELECTION OF GROUNDING AND BONDING PRODUCTS FOR COMMUNICATIONS

A. Comply with Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings."

3.4 INSTALLATION OF GROUNDING AND BONDING

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Grounding and Bonding Conductors:

a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
b. Underground Grounding Conductors:

1) Bury at least 30 inch (750 mm) below grade.
2) Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.

2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.

g. Grounding and Bonding for Piping:

1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to

main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.

3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install **tinned** bonding jumper to bond across flexible duct connections to achieve continuity.

i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft (18 m) apart.

3. Grounding and Bonding Busbars:

a. Install busbar horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.

b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.

4. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch (50 mm) below finished floor or final grade unless otherwise indicated.

1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2) Use exothermic welds for below-grade connections.

b. For grounding electrode system, install at least **three** rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

c. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch (300 mm) deep, with cover.

1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

See the Evaluations for discussion on ring electrodes.

d. Ring Electrode: Install grounding conductor, electrically connected to each building structure ground rod and to each **steel column**, extending around perimeter of **building**.

1) Install tinned-copper conductor not less than **2/0 AWG** for ring electrode and for taps to building steel.

2) Bury ring electrode not less than [**24 inch (600 mm)**] from building's foundation.

e. Concrete-Encased Electrode (Ufer Ground):

1) Fabricate in accordance with NFPA 70; use minimum of **20 ft (6 m)** of bare copper conductor not smaller than **4 AWG**.

a) If concrete foundation is less than [**20 ft (6 m)**] <**Insert dimension**> long, coil excess conductor within base of foundation.
b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft (6.0 m) long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.

5. Grounding at Service:

a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.

6. Grounding Separately Derived Systems:

a. Permanent Generators: Install grounding electrode(s) at location of permanent generators having switched neutral connections. Electrode must be connected to equipment grounding conductor and to frame of generator.

7. Grounding Underground Distribution System Components:

a. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.
b. Comply with IEEE C2 grounding requirements.
c. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch (50 mm) above to 6 inch (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
d. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields in accordance with manufacturer's published instructions with splicing and termination kits.

e. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch (150 mm) from foundation.

8. Equipment Grounding and Bonding:

a. Install insulated equipment grounding conductors with feeders and branch circuits.

b. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

c. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

d. Isolated Grounding Receptacle Circuits: Install insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

e. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

f. Poles Supporting Outdoor Lighting Fixtures: Bond insulated equipment grounding conductor to equipment grounding terminal inside pole base.

g. Metallic Fences: Comply with requirements of IEEE C2.

1) Grounding Conductor: Bare**, tinned** copper, not less than **8 AWG**.
2) Gates: Must be bonded to grounding conductor with flexible bonding jumper.
3) Barbed Wire: Strands must be bonded to grounding conductor.

Retain "Fence Grounding" Subparagraph below if fence other than that enclosing electrical distribution equipment is to be grounded.

3.5 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

A. Field tests and inspections must be witnessed by [**Architect**] [**Tenant**] [**authorities having jurisdiction**].

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.

3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**, at ground test wells, and at individual ground rods**. Make tests at ground rods before conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
    c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

D. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

    a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: **10 Ω**.
    b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: **5 Ω**.
    c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: **3 Ω**.
    d. Power Distribution Units or Panelboards Serving Electronic Equipment: **3 Ω**.
    e. Substations and Pad-Mounted Equipment: **5 Ω**.
    f. Manhole Grounds: **10 Ω**.

3.6 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittals: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ABB, Electrification Business.
   b. Allied Tube & Conduit; Atkore International.
   c. Atkore Unistrut.
   d. CADDY; brand of nVent Electrical plc.
   e. Cooper B-line; brand of Eaton, Electrical Sector.
   f. Flex-Strut Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: **Galvanized steel or Stainless steel**.
4. Channel Width: **Selected for applicable load criteria**.
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Atkore Unistrut.
    c. Eaton.
    d. Flex-Strut Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channel Material: 6063-T5 aluminum alloy.
4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
5. Channel Width: **Selected for applicable load criteria**
6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center, in at least one surface.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Allied Tube & Conduit; Atkore International.
    b. Atkore Unistrut.
    c. Champion Fiberglass, Inc.
    d. Cooper B-line; brand of Eaton, Electrical Sector.
    e. Fabco Plastics Wholesale Limited.
    f. G-Strut.
    g. Haydon Corporation.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channel Width: **Selected for applicable load criteria**.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles**, except metal items may be stainless steel**.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Conduit and Cable Support Devices: **Steel and malleable-iron** or **Stainless steel** hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Hilti, Inc.
2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
3) MKT Fastening, LLC.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [**zinc-coated**] [**stainless**] steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) Cooper B-line; brand of Eaton, Electrical Sector.
2) Empire Industries, Inc.
3) Hilti, Inc.
4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
6. Toggle Bolts: [**All**] [**Stainless**] steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA NEIS 101
2. NECA NEIS 102.
3. NECA NEIS 105.
4. NECA NEIS 111.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways specified in Section 260533.13 "Conduits for Electrical Systems."

D. Comply with requirements for boxes specified in Section 260533.16 "Boxes and Covers for Electrical Systems."

E. Provide **vibration and seismic** controls with hangers and supports in accordance with requirements specified in **"Section 260548 "Vibration and Seismic Controls for Electrical Systems."**

In "Maximum Support Spacing and Minimum Hanger Rod Size for Raceways" Paragraph below, spacings for supports in NECA NEIS 1, Table 1 are more detailed, specific, and generally stricter than those permitted by NFPA 70 for EMT, IMC, and ERMC. Revise to suit Project, and consider retaining reference to NECA table for critical projects.

F. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as **required by** NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.

G. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**]support system, sized so capacity can be increased by at least **25** percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with **single-bolt conduit clamps using spring friction action for retention in support channel**.

H. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch (38 mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, **EMT**, **IMC and ERMC** may be supported by openings through structure members, in accordance with NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch (100 mm) thick.
6. To Steel: **Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69**.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate **by means that comply with seismic-restraint strength and anchorage requirements**.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inch (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use **3000 psi (20.7 MPa)**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

2. Comply with requirements in **Section 099113 "Exterior Painting"**, **Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings"** for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 260529

SECTION 260533.13

CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.
12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

C. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).
4. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.

1.2 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.
12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

B. Sustainable design submittals.

1. Solvent cements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Type EMT-A and Type EMT-SS duct raceways and elbows.
2. Type EMT-S duct raceways and elbows.
3. Type ENT duct raceways and fittings.
4. Type HDPE and Type EPEC duct raceways and fittings.
5. Type ERMC-A and Type ERMC-SS duct raceways, elbows, couplings, and nipples.
6. Type ERMC-S duct raceways, elbows, couplings, and nipples.
7. Type FMC-S and Type FMC-A duct raceways.
8. Type FMT duct raceways.
9. Type IMC duct raceways.
10. Type LFMC duct raceways.
11. Type LFNC duct raceways.
12. Type PVC duct raceways and fittings.
13. Type RTRC-AG duct raceways and fittings.
14. Type RTRC-BG duct raceways and fittings.
15. Fittings for conduit, tubing, and cable.
16. Electrically conductive corrosion-resistant compounds for threaded conduit.
17. Solvent cements.

PART 2 - PRODUCTS

2.1 TYPE EMT-A AND TYPE EMT-SS DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Aluminum Electrical Metal Tubing (EMT-A) and Elbows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Conduit; Norsk Hydro ASA, Hydro Extrusion USA LLC.
b. Patriot Aluminum Products, LLC.
c. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.

2. Material: Aluminum.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
b. Colors: As indicated on Drawings.

D. UL FJMX - Stainless Steel Electrical Metal Tubing (EMT-SS) and Elbows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Calconduit; Atkore International.
b. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V.

2. Material: Stainless steel.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**..
b. Colors: As indicated on Drawings.

2.2 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:.

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Allied Tube & Conduit; Atkore International.
   b. Calconduit; Atkore International.
   c. Emerson Electric Co., Automation Solutions.
   d. Picoma; Zekelman Industries.
   e. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
   f. Topaz Lighting & Electric.
   g. Western Tube; Zekelman Industries.
   h. Wheatland Tube; Zekelman Industries.

2. Material: Steel.
3. Options:

   a. Exterior Coating: Z**inc**.
   b. Interior Coating: **Zinc with organic top coating**.
   c. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**].
   d. Colors: As indicated on Drawings.

2.3 TYPE ENT DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FKHU; including UL 1653.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FKHU - Electrical Nonmetallic Tubing (ENT) and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Cantex Inc.
    c. JM Eagle.

2. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
    b. Fittings:

        1) Mechanically Attached Fittings: UL 1653.
        2) Solvent-Attached Fittings: UL 651.

2.4 TYPE HDPE AND TYPE EPEC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN EAZX; including UL 651A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL EAZX - Schedule 40 Electrical HDPE Underground Conduit (HDPE-40):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Blue Diamond Industries, LLC.
    b. JM Eagle.
    c. Petroflex North America.
    d. Prysmian Cables and Systems; Prysmian Group North America.
    e. Southwire Company, LLC.

2. Dimensional Specifications: Schedule 40.
3. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.

D. UL EAZX - Schedule 80 Electrical HDPE Underground Conduit (HDPE-80):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Blue Diamond Industries, LLC.
b. JM Eagle.
c. Petroflex North America.
d. Prysmian Cables and Systems; Prysmian Group North America.
e. Southwire Company, LLC.

2. Dimensional Specifications: Schedule 80.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.

2.5 TYPE ERMC-A AND TYPE ERMC-SS DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYWV; including UL 6A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYWV - Aluminum Electrical Rigid Metal Conduit (ERMC-A), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. American Conduit; Norsk Hydro ASA, Hydro Extrusion USA LLC.
d. Appleton; Emerson Electric Co., Automation Solutions.
e. Calconduit; Atkore International.
f. Crouse-Hinds; brand of Eaton, Electrical Sector.
g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Patriot Aluminum Products, LLC.
i. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
j. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
k. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V.
l. Topaz Lighting & Electric.
m. Western Tube; Zekelman Industries.
n. Wheatland Tube; Zekelman Industries.

2. Material: Aluminum.
3. Options:

a. Protective Coating: Provide protective coating for **use in concrete**, **direct burial** and **use in severely corrosive environment**.
b. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
c. Colors: As indicated on Drawings.

D. UL DYWV - Stainless Steel Electrical Rigid Metal Conduit (ERMC-SS), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. Calconduit; Atkore International.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Patriot Aluminum Products, LLC.

2. Material: Stainless steel.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
b. Colors: As indicated on Drawings.

2.6 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; Atkore International.
b. Calconduit; Atkore International.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
e. Patriot Aluminum Products, LLC.
f. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
g. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V.

h. Topaz Lighting & Electric.
i. Western Tube; Zekelman Industries.
j. Wheatland Tube; Zekelman Industries.

2. Exterior Coating: Zinc.
3. Options:

a. Interior Coating: **Zinc with organic top coating**.
b. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
c. Colors: As indicated on Drawings.

D. UL DYIX - PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Bluesteel Services LLC.
c. Calbond; Atkore International.
d. KorKap; Robroy Industries.
e. Perma-Cote; Robroy Industries.
f. Plasti-Bond; Robroy Industries.

2. Options:

a. Exterior Coating: PVC complying with NEMA RN 1.
b. Interior Coating: **Zinc with organic top coating**.
c. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
d. Colors: As indicated on Drawings.
e. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
f. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

2.7 TYPE FMC-S AND TYPE FMC-A DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXUZ; including UL 1.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXUZ - Steel Flexible Metal Conduit (FMC-S):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Anaconda Sealtite; Anamet Electrical, Inc.
    c. Electri-Flex Company.
    d. International Metal Hose Co.
    e. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
    f. Topaz Lighting & Electric.

2. Material: Steel.
3. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**..
    b. Colors: As indicated on Drawings.

D. UL DXUZ - Aluminum Flexible Metal Conduit (FMC-A):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Anaconda Sealtite; Anamet Electrical, Inc.
    c. Electri-Flex Company.
    d. Topaz Lighting & Electric.

2. Options:

    a. Minimum Trade Size: [**Metric designator 16 (trade size 1/2)**] [**Metric designator 21 (trade size 3/4)**].
    b. Colors: As indicated on Drawings.

2.8 TYPE FMT DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN ILJW; including UL Subject 1652.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL ILJW - Steel Flexible Metallic Tubing (FMT):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Electri-Flex Company.
    b. International Metal Hose Co.
    c. Liquid Tight Connector Co.
    d. Southwire Company, LLC.

2. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
    b. Colors: As indicated on Drawings.

2.9 TYPE IMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYBY; including UL 1242.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYBY - Steel Intermediate Metal Conduit (IMC):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Calconduit; Atkore International.
    d. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
    e. Rymco USA brand; manufactured and listed by subsidiary Conduit S.A. de C.V.
    f. Topaz Lighting & Electric.
    g. Western Tube; Zekelman Industries.
    h. Wheatland Tube; Zekelman Industries.

2. Options:

    a. Exterior Coating: **Zinc**.
    b. Interior Coating: **Zinc with organic top coating**.
    c. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**].
    d. Colors: As indicated on Drawings.

2.10 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Anaconda Sealtite; Anamet Electrical, Inc.
c. Electri-Flex Company.
d. International Metal Hose Co.

2. Material: Steel.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
b. Colors: As indicated on Drawings.

D. UL DXHR - Stainless Steel Liquidtight Flexible Metal Conduit (LFMC-SS):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Anaconda Sealtite; Anamet Electrical, Inc.
c. Electri-Flex Company.

2. Material: Stainless steel.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
b. Colors: As indicated on Drawings.

2.11 TYPE LFNC DUCT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DXOQ; including UL 1660.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXOQ - Layered (Type A) Liquidtight Flexible Nonmetallic Conduit (LFNC-A):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. AFC Cable Systems; Atkore International.
    b. Electri-Flex Company.
    c. Topaz Lighting & Electric.

2. Additional Criteria: Type A conduit with smooth seamless inner core and cover bonded together with one or more reinforcement layers between core and cover.
3. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
    b. Colors: As indicated on Drawings.
    c. Markings: **80 deg C dry**.

D. UL DXOQ - Integral (Type B) Liquidtight Flexible Nonmetallic Conduit (LFNC-B):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Cambridge Resources.
    c. Electri-Flex Company.
    d. Superflex Ltd.
    e. Topaz Lighting & Electric.

2. Additional Criteria: Type B conduit with smooth inner surface with integral reinforcement within conduit wall.
3. Options:

    a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**..
    b. Colors: As indicated on Drawings.

E. UL DXOQ - Corrugated (Type C) Liquidtight Flexible Nonmetallic Conduit (LFNC-C):

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. HellermannTyton.

2. Additional Criteria: Type C conduit with corrugated internal and external surfaces without integral reinforcement within conduit wall.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.
b. Colors: As indicated on Drawings.

2.12 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Calconduit; Atkore International.
c. JM Eagle.
d. NAPCO; Westlake Chemical Corp.
e. National Pipe and Plastic, Inc. (Oldcastle).
f. Opti-Com Manufacturing Network, Inc (OMNI).
g. Topaz Lighting & Electric.

2. Dimensional Specifications: Schedule 40.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.

D. UL DZYR - Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Calconduit; Atkore International.
c. JM Eagle.

d. National Pipe and Plastic, Inc. (Oldcastle).
e. Opti-Com Manufacturing Network, Inc (OMNI).
f. Topaz Lighting & Electric.

2. Dimensional Specifications: Schedule 80.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.

E. UL DZYR - Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Southern Pipe, Inc.

2. Dimensional Specifications: Type A.
3. Options:

a. Minimum Trade Size: **Metric designator 21 (trade size 3/4)**.

2.13 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL EBMB - Duct Fittings for Hazardous (Classified) Locations:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Crouse-Hinds; brand of Eaton, Electrical Sector.
b. Power Feed-Thru Systems and Connectors LLC.

2. Listing Criteria: UL CCN EBMB; including UL 1203.

D. UL DWTT - Fittings for Type ERMC, Type IMC, Type PVC, Type HDPE, Type EPEC, and Type RTRC Duct Raceways:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Konkore Fittings; Atkore International.
e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
f. Penn Aluminum Conduit & EMT; Penn Aluminum International LLC; Berkshire Hathaway.
g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Southwire Company, LLC.
i. Topaz Lighting & Electric.

2. Listing Criteria: UL CCN DWTT; including UL 514B.
3. Options:

a. Material: **Steel**.
b. Coupling Method: **Compression coupling**. **Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable**.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

E. UL FKAV - Fittings for Type EMT Duct Raceways:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. Appleton; Emerson Electric Co., Automation Solutions.
d. Calconduit; Atkore International.
e. Crouse-Hinds; brand of Eaton, Electrical Sector.
f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Southwire Company, LLC.
i. Topaz Lighting & Electric.

2. Listing Criteria: UL CCN FKAV; including UL 514B.
3. Options:

a. Material: **Steel**.
b. Coupling Method: **Compression coupling**. **Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable**.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

F. UL ILNR - Fittings for Type FMC Duct Raceways:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Fittings Corp. (AMFICO).
b. Liquid Tight Connector Co.
c. Southwire Company, LLC.

2. Listing Criteria: UL CCN ILNR; including UL 514B.

G. UL DXAS - Fittings for Type LFMC and Type LFNC Duct Raceways:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Arlington Industries, Inc.
    b. Liquid Tight Connector Co.
2. Listing Criteria: UL CCN DXAS; including UL 514B.

2.14 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria: UL CCN DWTT; including UL 514B.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.1 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Special Instructions Regarding HDPE Conduits: Although Article 353 of NFPA 70 permits use of HDPE conduits where encased in concrete aboveground, UL CCN EAZX listing requirements state that HDPE **and EPEC** underground conduits are intended only for use where direct buried with or without being encased in concrete. Specified Type HDPE **and Type EPEC** underground conduits are not permitted to be used aboveground on Project.

C. Outdoors:

1. Exposed and Subject to Severe Physical Damage: **ERMC** or **IMC**.
2. Exposed and Subject to Physical Damage: **ERMC** or **IMC**.

    a. Locations less than 2.5 m (8 ft) above finished floor.

3. Exposed and Not Subject to Physical Damage: **ERMC**, **IMC**, or **Corrosion-resistant EMT**.
4. Concealed Aboveground: **ERMC**, **IMC**, **EMT**.

5. Direct Buried: **PVC-80** .
6. Concrete Encased Not in Trench: **PVC-80**, **PVC-40**.
7. Concrete Encased in Trench: **PVC-80**, **PVC-40**.
8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.

D. Indoors:

1. Hazardous Classified Locations: **ERMC, IMC**.
2. Exposed and Subject to Severe Physical Damage: **ERMC**, **IMC**. Locations include the following:

    a. Loading docks.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.

3. Exposed and Subject to Physical Damage: **ERMC, IMC, EMT**. Locations include the following:

    a. Locations less than 2.5 m (8 ft) above finished floor.
    b. Stub-ups to above suspended ceilings.

4. Exposed and Not Subject to Physical Damage: **ERMC. IMC. EMT**.
5. Concealed in Ceilings and Interior Walls and Partitions: **ERMC**, **IMC**, ,**EMT**.
6. Damp or Wet Locations: **ERMC, IMC**, **RTRC-AG**.
7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.

E. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.2 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Type EMT-A: Article 358 of NFPA 70 and NECA NEIS 102.
2. Type EMT-SS: Article 358 of NFPA 70 and NECA NEIS 101.
3. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
4. Type ENT: Article 362 of NFPA 70 and NECA NEIS 102.
5. Type HDPE and Type EPEC: Article 353 of NFPA 70 and NECA NEIS 111.
6. Type ERMC-A: Article 344 of NFPA 70 and NECA NEIS 102.
7. Type ERMC-SS: Article 344 of NFPA 70 and NECA NEIS 101.
8. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
9. Type FMC-S: Article 348 of NFPA 70 and NECA NEIS 101.
10. Type FMC-A: Article 348 of NFPA 70 and NECA NEIS 102.
11. Type FMT: Article 360 of NFPA 70 and NECA NEIS 101.

12. Type IMC: Article 342 of NFPA 70 and NECA NEIS 101.
13. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
14. Type LFNC: Article 342 of NFPA 70 and NECA NEIS 111.
15. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
16. Type RTRC: Article 355 of NFPA 70 and NECA NEIS 111.
17. Expansion Fittings: NEMA FB 2.40.
18. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:

a. Complete duct raceway installation before starting conductor installation.
b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft (0.6 m) above finished floor.
c. Install no more than equivalent of three 90-degree bends in conduit run **except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted**. Support within 12 inch (300 mm) of changes in direction.
d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
f. Support conduit within 12 inch (300 mm) of enclosures to which attached.
g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:

1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2) Where an underground service duct raceway enters a building or structure.
3) Conduit extending from interior to exterior of building.
4) Conduit extending into pressurized duct raceway and equipment.
5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6) Where otherwise required by NFPA 70.

i. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
j. Keep duct raceways at least 6 inch (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
k. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
l. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.

m. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

1) Termination fittings with shoulders do not require two locknuts.

n. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. **Install insulated throat metal grounding bushings on service conduits**.

2. Types EMT-A, ERMC-A, and FMC-A: Do not install aluminum duct raceways or fittings in contact with concrete or earth.
3. Types ERMC and IMC:

a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

4. Type ERMC-S-PVC:

a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC duct raceway.
c. Coat field-cut threads on PVC-coated duct raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

5. Types FMC, LFMC, and LFNC:

Retain second option in first subparagraph below if flexible connections are required for recessed and semirecessed luminaires.

a. Provide a maximum of **36 inch (915 mm)** of flexible conduit for [**recessed and semirecessed luminaires,**]equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

6. Types PVC, HDPE, and EPEC:

a. Do not install Type PVC, Type HDPE, or Type EPEC conduit where ambient temperature exceeds **122 deg F (50 deg C)**. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
b. Comply with manufacturer's published instructions for solvent welding and fittings.

7. Type RTRC: Do not install Type RTRC conduit where ambient temperature exceeds **230 deg F (110 deg C)**.
8. Duct Raceways Embedded in Slabs:

a. **Run duct raceways larger than metric designator 27 (trade size 1) below concrete slab**.
b. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.
c. Arrange duct raceways to ensure that each is surrounded by minimum of **1 inch (25 mm)**] [**2 inch (50 mm)** of concrete without voids.
d. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.

e. Change from ENT to **PVC-80 or IMC** before rising above floor.

9. Stub-ups to Above Recessed Ceilings:

a. Provide EMT, IMC, or ERMC for duct raceways.
b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

10. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG. **Install insulated throat metal grounding bushings on service conduits**.

11. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

a. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
b. EMT: Provide [**setscrew**] [**compression**], [**steel**] [**cast-metal**] fittings. Comply with NEMA FB 2.10.
c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

12. Expansion-Joint Fittings:

a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft (7.6 m). Install in runs of aboveground ERMC[**and EMT**] conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft (30 m).
b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

1) Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
2) Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
3) Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
4) Attics: **135 deg F (75 deg C)** temperature change.

c. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run

per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.

d. Install expansion fittings at locations where conduits cross building or structure expansion joints.

e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

13. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty **or firestopping**.

14. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.

    a. Provide warning signs.

D. Interfaces with Other Work:

1. Coordinate with Section 078413 "Penetration Firestopping" for installation of firestopping at penetrations of fire-rated floor and wall assemblies.
2. Coordinate with Section 260529 "Hangers and Supports for Electrical Systems" for installation of conduit hangers and supports.

3.3 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533.13

SECTION 260533.16

BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

C. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

B. Shop Drawings:

1. Shop drawings for floor boxes.

C. Samples:

1. Floor box samples for initial selection.
2. Raised floor box samples for initial selection.
3. Recessed access-floor box samples for initial selection.
4. Concrete box samples for initial selection.

D. Sustainable design submittals.

1. Nonmetallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Nonmetallic outlet boxes, device boxes, rings, and covers.
3. Junction boxes and pull boxes.
4. Cover plates for device boxes.
5. Hoods for outlet boxes.

PART 2 - PRODUCTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
3. Samples:

a. Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.
b. Raised Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.
c. Recessed Access-Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.
d. Concrete Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arlington Industries, Inc.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
i. Pass & Seymour; Legrand North America, LLC.
j. Spring City Electrical Manufacturing Company.
k. Wiremold; Legrand North America, LLC.

3. Options:

a. Material: **Sheet steel, Sheet aluminum, or Cast metal as required**.
b. Sheet Metal Depth: Minimum **3.5 inch (90 mm)**.
c. Cast-Metal Depth: Minimum **2.4 inch (60.3 mm)**.
d. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing **up to 50 lb (23 kg) and marked with maximum allowable weight**.
e. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
e. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
f. Pass & Seymour; Legrand North America, LLC.
g. Patriot Aluminum Products, LLC.
h. Plasti-Bond; Robroy Industries.
i. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
j. Topaz Lighting & Electric.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arlington Industries, Inc.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
i. Patriot Aluminum Products, LLC.
j. Plasti-Bond; Robroy Industries.
k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
l. Topaz Lighting & Electric.

3. Options:

a. Material: **Sheet steel, Sheet aluminum, Cast metal**.
b. Sheet Metal Depth: minimum **3.5 inch (90 mm)**.
c. Cast-Metal Depth: minimum **2.4 inch (60.3 mm)**.

F. UL QCIT - Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Crouse-Hinds; brand of Eaton, Electrical Sector.
e. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
f. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
g. Pass & Seymour; Legrand North America, LLC.
h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
i. Topaz Lighting & Electric.

G. UL QCIT - Metallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. AFC Cable Systems; Atkore International.
c. Arlington Industries, Inc.

d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
e. FSR Inc.
f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Leviton Manufacturing Co., Inc.
i. Pass & Seymour; Legrand North America, LLC.
j. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
k. Wiremold; Legrand North America, LLC.

H. UL QCIT - Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Crouse-Hinds; brand of Eaton, Electrical Sector.
c. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
d. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
e. Topaz Lighting & Electric.
f. Wiremold; Legrand North America, LLC.

2.2 NONMETALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCMZ; including UL 514C.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
3. Samples:

a. Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.
b. Raised Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.
c. Recessed Access-Floor Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.

d. Concrete Box Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors and flooring inserts for each type of floor box.

C. UL QCMZ - Nonmetallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. Appleton; Emerson Electric Co., Automation Solutions.
d. Arlington Industries, Inc.
e. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
f. Crouse-Hinds; brand of Eaton, Electrical Sector.
g. Ericson Manufacturing Company.
h. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
i. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
j. Intermatic, Inc.
k. Leviton Manufacturing Co., Inc.
l. Panduit Corp.
m. Pass & Seymour; Legrand North America, LLC.
n. Wiremold; Legrand North America, LLC.

D. UL QCMZ - Nonmetallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.
c. Arlington Industries, Inc.
d. Cantex Inc.
e. JM Eagle.
f. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Topaz Lighting & Electric.

E. UL QCMZ - Nonmetallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Cantex Inc.
    e. Crouse-Hinds; brand of Eaton, Electrical Sector.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Pass & Seymour; Legrand North America, LLC.
    h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

F. UL QCMZ - Nonmetallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Cantex Inc.
    e. JM Eagle.
    f. Pass & Seymour; Legrand North America, LLC.
    g. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    h. Wiremold; Legrand North America, LLC.

G. UL QCMZ - Nonmetallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Arlington Industries, Inc.
    d. Cantex Inc.
    e. JM Eagle.
    f. Leviton Manufacturing Co., Inc.
    g. Wiremold; Legrand North America, LLC.

2.3 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Adalet.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. FSR Inc.
e. Hoffman; brand of nVent Electrical plc.
f. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Milbank Manufacturing Company.
i. N J Sullivan Company.
j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
k. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
l. Square D; Schneider Electric USA.

D. UL BGUZ - Indoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Adalet.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

E. UL BGUZ - Indoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Cantex Inc.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. JM Eagle.
    f. Robroy Enclosures; Robroy Industries.
    g. Topaz Lighting & Electric.

F. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Adalet.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Cooper B-line; brand of Eaton, Electrical Sector.
    d. Hoffman; brand of nVent Electrical plc.
    e. Hubbell Industrial Controls; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Milbank Manufacturing Company.
    h. N J Sullivan Company.
    i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    j. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    k. Spring City Electrical Manufacturing Company.
    l. Square D; Schneider Electric USA.

G. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Adalet.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Crouse-Hinds; brand of Eaton, Electrical Sector.
    d. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

H. UL BGUZ - Outdoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Allied Tube & Conduit; Atkore International.
    c. Cantex Inc.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    e. JM Eagle.
    f. Robroy Enclosures; Robroy Industries.
    g. Topaz Lighting & Electric.

2.4 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wallplate-Securing Screws: Metal with head color to match wallplate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. ABB, Electrification Business.
    b. Appleton; Emerson Electric Co., Automation Solutions.
    c. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    d. Crouse-Hinds; brand of Eaton, Electrical Sector.
    e. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    f. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    g. Intermatic, Inc.
    h. Leviton Manufacturing Co., Inc.
    i. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
    j. Panduit Corp.
    k. Pass & Seymour; Legrand North America, LLC.
    l. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    m. Topaz Lighting & Electric.

n. Wiremold; Legrand North America, LLC.

2. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
b. Wallplate Material: [**0.032 inch (0.8 mm) thick, Type 302/304 non-magnetic stainless steel with brushed finish**] [**0.040 inch (1.0 mm) thick aluminum, anodized or lacquered to prevent corrosion**] [**0.04 inch (1 mm) thick, brushed brass with factory polymer finish**] [**Steel with white baked enamel, suitable for field painting**] [**0.04 inch (1 mm) thick steel with chrome-plated finish**] [**Galvanized steel**] [**Cast aluminum**] [**As indicated on architectural Drawings**].

D. UL QCIT or QCMZ - Nonmetallic Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Arlington Industries, Inc.
d. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
e. Crouse-Hinds; brand of Eaton, Electrical Sector.
f. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
h. Intermatic, Inc.
i. Leviton Manufacturing Co., Inc.
j. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
k. Panduit Corp.
l. Pass & Seymour; Legrand North America, LLC.
m. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
n. Topaz Lighting & Electric.
o. Wiremold; Legrand North America, LLC.

2. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
b. Wallplate Material: [**0.060 inch (1.5 mm) thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device**] [**As indicated on architectural Drawings**].
c. Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].

E. UL QCIT or QCMZ - Illuminating Cover Plates for Device Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Leviton Manufacturing Co., Inc.

2. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
b. Wallplate Material: [**0.060 inch (1.5 mm) thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device**] [**As indicated on architectural Drawings**].
c. Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].

2.5 HOODS FOR OUTLET BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria:

a. UL CCN QCIT or UL CCN QCMZ; including UL 514D.
b. Receptacle, Hood, Cover Plate, Gaskets, and Seals: UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.

3. Mounts to box using fasteners different from wiring device.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Retractable or Reattachable Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Options:

a. Provides [**clear**] [**gray**] [**white**], weatherproof, "while-in-use" cover.

D. UL QCIT or QCMZ - Extra-Duty, While-in-Use Hoods for Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Allied Tube & Conduit; Atkore International.

c. Appleton; Emerson Electric Co., Automation Solutions.
d. Arlington Industries, Inc.
e. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
f. Intermatic, Inc.
g. Leviton Manufacturing Co., Inc.
h. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
3. Options:

a. Provides [**clear**] [**gray**] [**white**], weatherproof, "while-in-use" cover.
b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

3.1 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Shop Drawings for Floor Boxes: Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thickness **at location** where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

3.2 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

1. Outdoors:

a. **Type 3R** unless otherwise indicated.
b. Locations Exposed to Hosedown: **Type 4**.
c. Locations Subject to Potential Flooding: Type 6P.
d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
e. Locations in-Ground or Exposed to Corrosive Agents: **Type 4X**].
f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

2. Indoors

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: **Type 12**.
c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: **Type 12**.
e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: **Type 4**.
f. Locations Exposed to Hosedown: **Type 4**.

g. Locations Exposed to Brief Submersion: [**Type 6**] [**Type 6P**].

B. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:

1. **Provide cast-metal boxes**.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Set metal floor boxes level and flush with finished floor surface.
10. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
11. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
12. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
13. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

    a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
    b. Provide gaskets for wallplates and covers.

14. Identification: Provide labels for boxes and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.

b. Provide warning signs.
c. Label each box with engraved metal or laminated-plastic nameplate.

D. Interfaces with Other Work:

1. Coordinate with Section 260573.13 "Short-Circuit Studies" for determining available fault current on input feeder.
2. Coordinate with Section 260573.19 "Arc-Flash Hazard Analysis" for determining arc-flash hazard on input feeder.
3. Coordinate with <**Insert Section number and title**> for <**Insert description of**

3.4 CLEANING

A. Remove construction dust and debris from boxes before installing wallplates, covers, and hoods.

3.5 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.16

SECTION 260533.23

SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface metal raceways and fittings.
2. Surface nonmetallic raceways.
3. Strut-type channel raceways and fittings.
4. Wireways and auxiliary gutters.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

C. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Surface metal raceways and fittings.
2. Surface nonmetallic raceways.
3. Strut-type channel raceways and fittings.
4. Wireways and auxiliary gutters.

B. Samples:

1. Surface metal raceway nonmetallic cover samples for initial selection.
2. Surface nonmetallic raceway samples for initial selection.
3. Strut-type channel raceway nonmetallic covers for initial selection.
4. Nonmetallic wireway and auxiliary gutter samples for initial selection.

5. Surface metal raceways and fittings.
6. Surface nonmetallic raceways.
7. Strut-type channel raceways and fittings.
8. Wireways and auxiliary gutters.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Surface metal raceways and fittings.
2. Surface nonmetallic raceways.
3. Strut-type channel raceways and fittings.
4. Wireways and auxiliary gutters.

PART 2 - PRODUCTS

2.1 SURFACE METAL RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN RJBT; including UL 5.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
3. Samples:

a. Surface Metallic Raceway Nonmetallic Cover Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type, **12 inch (300 mm)** long.

C. UL RJBT - Surface Metal Raceways and Fittings with Metal Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
b. MonoSystems, Inc.
c. Wiremold; Legrand North America, LLC.

2. Options:

a. [**Galvanized steel**] [**Aluminum**] base with snap-on covers.

b. [**Manufacturer's standard enamel finish in color selected by Architect**] [**Prime coated, ready for field painting**].
c. Wiring Channels: **Single or Dual.** Multiple channels must be capable of housing a standard 20 to 30 A device flush within the raceway.

D. UL RJBT - Surface Metal Raceways and Fittings with Nonmetallic Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Union Products International, Inc.

2. Additional Characteristics: UL 94, V-0 requirements for self-extinguishing characteristics.
3. Options:

   a. [**Galvanized steel**] [**Aluminum**] base with snap-on covers.
   b. Provide texture and color selected by Architect from [**manufacturer's standard**] [**custom**] colors.
   c. Wiring Channels: [**Single**] [**Dual**] [**Triple**]. Multiple channels must be capable of housing a standard 20 to 30 A device flush within the raceway.

2.2 SURFACE NONMETALLIC RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:

   a. UL CCN RJTX; including UL 5A.
   b. UL 94, V-0 requirements for self-extinguishing characteristics.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
3. Samples:

   a. Surface Nonmetallic Raceway Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type, **12 inch** **(300 mm)** long.

C. UL RJTX - Surface Nonmetallic Raceways and Fittings with Nonmetallic Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Hubbell Premise Wiring; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
   c. Panduit Corp.
   d. Wiremold; Legrand North America, LLC.

2. Options:

a. Provide texture and color selected by Architect from [**manufacturer's standard**] [**custom**] colors.
b. Wiring Channels: [**Single**] [**Dual**]. Multiple channels must be capable of housing a standard 20 to 30 A device flush within the raceway.

2.3 WIREWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:

a. UL CCN ZOYX; including UL 870.
b. UL 94, V-0 requirements for self-extinguishing characteristics.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.
3. Samples:

a. Nonmetallic Wireway and Auxiliary Gutter Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type, **12 inch (300 mm)** long.

C. UL ZOYX - Metal Wireways and Auxiliary Gutters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Hoffman; brand of nVent Electrical plc.
d. MonoSystems, Inc.
e. Square D; Schneider Electric USA.
f. Wiegmann; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Additional Characteristics:

a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
b. Finish: Manufacturer's standard enamel finish.

3. Options:

a. Wireway Covers: [**Hinged type**] [**Screw-cover type**] [**Flanged-and-gasketed type**] unless otherwise indicated.

D. UL ZOYX - Nonmetallic Wireways and Auxiliary Gutters:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Hoffman; brand of nVent Electrical plc.

2. Additional Characteristics:

a. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings must match and mate with wireways as required for complete system.
b. PVC Solvents and Adhesives: As recommended by wireway manufacturer.

3. Options:

a. Material:

Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover must be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections must be flanged and have stainless steel screws and oil-resistant gaskets.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Auxiliary Gutters: Article 366 of NFPA 70.
2. Surface Metal Raceway: Article 386 of NFPA 70.
3. Surface Nonmetallic Raceway: Article 388 of NFPA 70.
4. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Install surface raceways only where indicated on Drawings.
2. Install surface raceway with a minimum 2 inch (50 mm) radius control at bend points.
3. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's published instructions. Tape and glue are unacceptable support methods.
4. Identification: Provide labels for surface raceways and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Provide warning signs.

3.2 CLEANING

A. Remove construction dust and debris from surface raceways before installing covers.

3.3 PROTECTION

A. After installation, protect surface raceways from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533.23

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Pourable sealants.
7. Foam sealants.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Steel Wall Sleeves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Advance Products & Systems, LLC.
b. CCI Piping Systems.
c. Flexicraft Industries.
d. GPT; a division of EnPRO Industries.
e. Specified Technologies Inc.

2. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Cast-Iron Wall Sleeves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Cast Iron Pipe Company.
b. Flexicraft Industries.
c. McWane Ductile; a part of the McWane family of companies.

2. General Characteristics: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. PVC Pipe Sleeves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CCI Piping Systems.
b. GPT; a division of EnPRO Industries.
c. Metraflex Company (The).

2. General Characteristics: ASTM D1785, Schedule 40.

D. Round, Galvanized-Steel, Sheet Metal Sleeves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Benefast.
b. Specified Technologies Inc.

2. General Characteristics: Galvanized-steel sheet; thickness not less than 0.0239 inch (0.6 mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

A. Rectangular, Galvanized-Steel, Sheet Metal Sleeves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Abesco Fire LLC.
b. Specified Technologies Inc.
c. Wiremold; Legrand North America, LLC.
d. Roxtec Inc.

2. General Characteristics:

a. Material: Galvanized sheet steel.
b. Minimum Metal Thickness:

1) For sleeve cross-section rectangle perimeter less than 50 inch (1270 mm) and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch (1.3 mm).
2) For sleeve cross-section rectangle perimeter not less than 50 inch (1270 mm) or with one or more sides larger than 16 inch (400 mm), thickness must be 0.138 inch (3.5 mm).

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Advance Products & Systems, LLC.
2. American Polywater Corporation.
3. BWM Company.
4. CALPICO, Inc.
5. Flexicraft Industries.
6. GPT; a division of EnPRO Industries.
7. Metraflex Company (The).
8. Proco Products, Inc.
9. Roxtec Inc.

B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

C. Options:

1. Sealing Elements: **EPDM** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: **Carbon steel**.
3. Connecting Bolts and Nuts: **Carbon steel, with corrosion-resistant coating,** of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Holdrite; a division of Reliance Worldwide Corporation.

B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Specified Technologies Inc.
2. W. R. Meadows, Inc.

B. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.6 POURABLE SEALANTS

Retain this article when use of pourable sealants is permitted as an alternative to grout in sealing of conduit or cable penetrations.

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Carlisle Syntec Systems.
2. GAF.
3. Johns Manville; a Berkshire Hathaway company.
4. Specified Technologies Inc.

B. Performance Criteria:

1. General Characteristics: Single-component, neutral-curing elastomeric sealants of grade indicated below.

a. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

FOAM SEALANTS

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Innovative Chemical Products (Building Solutions Group).
2. The Dow Chemical Company.

D. Performance Criteria:

1. General Characteristics: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structur

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide [**1/4 inch (6.4 mm)**] <**Insert dimension**> annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed[**or seismic criteria require different clearance**].
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior-Wall and Floor Penetrations:

1. Install [**steel**] [**cast-iron**] pipe sleeves with integral waterstops. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Install sleeve during construction of floor or wall.
2. Install steel pipe sleeves. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE-SEAL SYSTEMS

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 260544

SECTION 260548

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Restraints - rigid type.
3. Restraints - cable type.
4. Restraint accessories.
5. Post-installed concrete anchors.
6. Concrete inserts.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Elastomeric isolation pads.
2. Restraints - rigid type.
3. Restraints - cable type.
4. Restraint accessories.
5. Post-installed concrete anchors.
6. Concrete inserts.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
3. Show coordination of seismic and wind-load bracing for components with other systems and equipment in the vicinity, including other supports and seismic restraints.

C. Delegated Design Submittal for Each Seismic-Restraint Device: Signed and sealed by qualified structural professional engineer.

1. For each seismic-restraint device, including [**restraint - rigid and cable type,**] [**restraint accessory,**] [**and**] [**concrete anchor and insert**] that is required by this Section or is indicated on Drawings, submit the following:

    a. Seismic Restraints: Select seismic restraints complying with performance requirements, design criteria, and analysis data.
    b. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated seismic loads. Include certification that device is approved by qualified testing laboratory for seismic reinforcement use.
    c. Seismic Design Calculations: Submit input data and loading calculations prepared in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical" and Section 260011 "Facility Performance Requirements for Electrical."

D. Delegated Design Submittal for Each Wind-Load Protection Device: Signed and sealed by qualified structural professional engineer.

1. For each wind-load protection device, including **restraint - rigid and cable type, restraint accessory, and concrete anchor and insert** that is required by this Section or is indicated on Drawings, submit the following:

    a. Wind-Load Restraint: Select wind-load restraints complying with performance requirements, design criteria, and analysis data.
    b. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated wind loads. Include certification that device is approved by qualified testing laboratory for reinforcement use.
    c. Wind-Load Design Calculations: Submit static and dynamic loading calculations prepared in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical" and Section 260011 "Facility Performance Requirements for Electrical."

2. Seismic- and Wind-Load-Restraint Detail Drawings: Signed and sealed by qualified structural professional engineer.

    a. Design Analysis: To support selection and arrangement of seismic and wind-load restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint details with wind-load details required for equipment mounted outdoors.

3. Product Listing, Preapproval, and Evaluation Documentation: By **an agency acceptable to authorities having jurisdiction**, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

E. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage qualified structural professional engineer to design seismic and wind-load control system in accordance with criteria specified in Section 260010 "Supplemental Requirements for Electrical" and Section 260011 "Facility Performance Requirements for Electrical."

B. Seismic- and Wind-Load-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: **ICC-ES product listing**, **UL product listing**, **FM Approvals**, **an evaluation service member of ICC-ES**, **an agency acceptable to authorities having jurisdiction**.

C. Consequential Damage: Provide additional seismic and wind-load restraints for suspended components or anchorage of floor-, roof-, or wall-mounted components so that failure of a non-essential or essential component will not cause failure of any other essential building component.

D. Fire/Smoke Resistance: Seismic- and wind-load-restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by qualified testing laboratory in accordance with ASTM E84 or UL 723, and be so labeled.

E. Component Supports:

1. Load ratings, features, and applications of reinforcement components must be based on testing standards of qualified testing laboratory.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ace Mountings Co., Inc.
b. CADDY; brand of nVent Electrical plc.
c. California Dynamics Corporation.
d. Isolation Technology, Inc.
e. Kinetics Noise Control, Inc.
f. Korfund.
g. Mason Industries, Inc.
h. NOVIA; a division of Carpenter & Paterson.
i. Vibration Eliminator Co., Inc.
j. Vibration Isolation.
k. Vibration Management Corp.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
5. Surface Pattern: Smooth, ribbed, or waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Infused nonwoven cotton or synthetic fibers.

2.3 RESTRAINTS - RIGID TYPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Atkore Unistrut.
2. CADDY; brand of nVent Electrical plc.
3. California Dynamics Corporation.
4. Cooper B-line; brand of Eaton, Electrical Sector.
5. Hilti, Inc.
6. Isolation Technology, Inc.
7. TOLCO Incorporated.
8. VMC GROUP.

B. Description: Shop- or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CADDY; brand of nVent Electrical plc.
2. Cooper B-line; brand of Eaton, Electrical Sector.
3. Gripple Inc.
4. Loos & Co. Inc.
5. VMC GROUP.

B. Seismic- and Wind-Load-Restraint Cables: **ASTM A1023/A1023M galvanized or ASTM A603 galvanized-steel**, **ASTM A492 stainless steel** cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.

C. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. Cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.5 RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Atkore Unistrut.
2. CADDY; brand of nVent Electrical plc.
3. Cooper B-line; brand of Eaton, Electrical Sector.
4. Hilti, Inc.
5. Loos & Co. Inc.
6. Mason Industries, Inc.
7. TOLCO Incorporated.

B. Hanger-Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections** to hanger rod. Non-metallic stiffeners are unacceptable.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to **rigid channel bracings and restraint cables**.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.6 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Atkore Unistrut.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Hilti, Inc.
d. Mason Industries, Inc.
e. Powers Fasteners.

2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

B. Adhesive Anchor Bolts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Atkore Unistrut.

b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Hilti, Inc.
d. Mason Industries, Inc.
e. Powers Fasteners.

2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E488M.

C. Provide post-installed concrete anchors that have been prequalified for use in seismic and wind-load applications.

1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.7 CONCRETE INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Atkore Unistrut.
2. Cooper B-line; brand of Eaton, Electrical Sector.
3. Hilti, Inc.
4. Mason Industries, Inc.
5. Powers Fasteners.

B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC446 testing.

C. Comply with MSS SP-58.

2.8 SOURCE QUALITY CONTROL

A. Product Data: Prepare and submit catalog cuts, brochures, **diagrams, schedules,** and performance data illustrating size, physical appearance, and other characteristics of product.

1. Include rated load capacity for each seismic- and wind-load-restraint device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic- and wind-load-restraint component used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic and wind-load control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by **an agency acceptable to authorities having jurisdiction**.

B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static, wind load, and seismic loads within specified loading limits.

3.3 INSTALLATION OF SEISMIC-RESTRAINT AND WIND-LOAD CONTROL DEVICES

A. Provide seismic restraint and wind-load control devices for systems and equipment where indicated in Equipment Schedules or Seismic and Wind-Load Controls Schedule, where indicated on Drawings, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

1. Install equipment and devices to withstand the effects of earthquake motions and high wind events.

B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

C. Installation of seismic and wind-load restraints must not cause any stresses, misalignment, or change of position of equipment or conduits.

D. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint and wind-load-restraint devices using methods approved by **an agency acceptable to authorities having jurisdiction**] that provides required submittals for component.

E. Raceway, Cable, Wireway, Cable Tray, and Busway Support and Hanger Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint and wind-load-restraint devices using methods approved by **an agency acceptable to authorities having jurisdiction** that provides required submittals for component.
3. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

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4. Install seismic-restraint devices using methods approved by **an agency acceptable to authorities having jurisdiction** providing required submittals for component.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Post-Installed Concrete Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Field tests must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test no fewer than **four** of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

C. Nonconforming Work:

1. Seismic controls will be considered defective if they do not pass tests and inspections.
2. Remove and replace malfunctioning units and retest as specified above.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

END OF SECTION 260548

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Extruded insulating tubing.
3. Bands.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 LABELS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN PGDQ2 for components; including UL 969.

B. UL PGDQ2 - Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Champion America.
c. Grafoplast Wire Markers.
d. HellermannTyton.
e. LEM Products Inc.
f. Marking Services Inc.
g. Panduit Corp.
h. Seton Identification Products; a Brady Corporation company.
i. emedco.

C. UL PGDQ2 - Self-Adhesive Wraparound Labels: **Preprinted**, 3 mil (0.08 mm) thick, **polyester** flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Grafoplast Wire Markers.
e. Ideal Industries, Inc.
f. LEM Products Inc.
g. Marking Services Inc.
h. Panduit Corp.
i. Seton Identification Products; a Brady Corporation company.
j. emedco.

2. Self-Lamination: Clear; UV-, weather-, and chemical-resistant; self-laminating, with protective shield over legend. Size labels such that clear shield overlaps entire printed legend.
3. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.

D. UL PGDQ2 - Self-Adhesive Labels: **Polyester**, thermal, transfer-printed, 3 mil (0.08 mm) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. Grafoplast Wire Markers.

e. HellermannTyton.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services Inc.
i. Panduit Corp.
j. Seton Identification Products; a Brady Corporation company.
k. emedco.

2. Minimum Nominal Size:

a. 1-1/2 by 6 inch (37 by 150 mm) for raceway and conductors.
b. 3-1/2 by 5 inch (76 by 127 mm) for equipment.
c. As required by authorities having jurisdiction.

2.2 EXTRUDED INSULATING TUBING

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN YDPU2 for components; including UL 224.

B. UL YDPU2 - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F (93 deg C).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Panduit Corp.

2.3 BANDS

A. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services Inc.
d. Panduit Corp.
e. Seton Identification Products; a Brady Corporation company.

B. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. HellermannTyton.
    c. Marking Services Inc.
    d. Panduit Corp.

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Champion America.
    d. HellermannTyton.
    e. Ideal Industries, Inc.
    f. Marking Services Inc.
    g. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil (0.08 mm) thick by 1 to 2 inch (25 to 50 mm) wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Marking Services Inc.
    d. emedco.

C. Tape and Stencil: 4 inch (100 mm) wide black stripes on 10 inch (250 mm) centers placed diagonally over orange background and are 12 inch (300 mm) wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. HellermannTyton.
    b. LEM Products Inc.
    c. Marking Services Inc.
    d. Pipemarker.com; Brimar Industries, Inc.
    e. Seton Identification Products; a Brady Corporation company.

D. Floor Marking Tape: 2 inch (50 mm) wide, 5 mil (0.125 mm) pressure-sensitive vinyl tape, with **yellow and black** stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Seton Identification Products; a Brady Corporation company.

E. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Ideal Industries, Inc.
    c. LEM Products Inc.
    d. Marking Services Inc.
    e. Pipemarker.com; Brimar Industries, Inc.
    f. Reef Industries, Inc.
    g. Seton Identification Products; a Brady Corporation company.

2. Tape:

    a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical **and communications** utility lines.
    b. Printing on tape must be permanent and may not be damaged by burial operations.
    c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

    a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
    b. Inscriptions for Red Tapes: **"CAUTION BURIED ELECTRIC LINE BELOW"**.
    c. Inscriptions for Orange Tapes: **"CAUTION BURIED COMMUNICATION LINE BELOW"**.

4. Nonconducting Line-Warning Tape <**Insert drawing designation**>:

    a. Pigmented polyolefin, bright colored, [**continuous-printed on one side with inscription of utility,**]compounded for direct-burial service.
    b. Width: 3 inch (75 mm).
    c. Thickness: 4 mil (0.1 mm).
    d. Weight: 18.5 lb/1000 sq. ft (9.0 kg/100 sq. m).
    e. Tensile in accordance with ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

5. Reinforced Nonconducting Line-Warning Tape <**Insert drawing designation**>:

    a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, [**continuous-printed on one side with inscription of utility,**]compounded for direct-burial service.
    b. Width: 3 inch (75 mm).
    c. Thickness: 12 mil (0.3 mm).

d. Weight: 36.1 lb/1000 sq. ft (17.6 kg/100 sq. m).
e. Tensile in accordance with ASTM D882: 400 lbf (1780 N) and 11,500 psi (79.2 MPa).

6. Detectable Line-Warning Tape <**Insert drawing designation**>:

a. Detectable three-layer laminate, consisting of printed pigmented polyolefin film, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright colored, [**continuous-printed on one side with inscription of utility,**]compounded for direct-burial service.
b. Width: 3 inch (75 mm).
c. Overall Thickness: 5 mil (0.125 mm).
d. Foil Core Thickness: 0.35 mil (8.9 m).
e. Weight: 28 lb/1000 sq. ft (13.7 kg/100 sq. m).
f. Tensile in accordance with ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

7. Reinforced Detectable Line-Warning Tape <**Insert drawing designation**>:

a. Reinforced, detectable three-layer laminate, consisting of printed pigmented woven scrim, solid aluminum-foil core, and clear protective film that allows inspection of continuity of conductive core; bright-colored, [**continuous-printed on one side with inscription of utility,**]compounded for direct-burial service.
b. Width: 3 inch (75 mm).
c. Overall Thickness: 8 mil (0.2 mm).
d. Foil Core Thickness: 0.35 mil (8.9 m).
e. Weight: 34 lb/1000 sq. ft (16.6 kg/100 sq. m).
f. Tensile in accordance with ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

F. Concrete Cable Route Markers:

1. Description: Concrete markers visually aid tracing the route of electrical cables. Monument markers are typically installed at grade. Protective cover markers are typically installed above the cables at grade or below grade.
2. Product Characteristics:

a. Material: Precast reinforced concrete.
b. Marker Type:

1) Above-Ground Monument Post:

a) Nominal Dimensions (Height, Width, Depth): 30 inch (760 mm), 6 inch (150 mm), 3 inch (75 mm).

c. Legend: **"DANGER - ELECTRICITY"** .
d. Lettering: Approximately 1/8 inch (3 mm) deep, not less than **1 inch (25 mm)** high, symmetrically spaced; marked on both sides to allow for reversal.

3. Required Product Options:

a. Color: **Red** dye added to concrete during batching.
b. Attach metal medallion or sign stamped with **feeder number**.

G. Stenciled Legend: In nonfading, waterproof, **black** ink or paint. Minimum letter height must be **1 inch (25 mm)**.

2.5 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Marking Services Inc.
d. Seton Identification Products; a Brady Corporation company.
e. emedco.

B. Nonmetallic Preprinted Tags: Polyethylene tags, **0.015 inch (0.38 mm)** thick, color-coded for phase and voltage level, with factory **screened** or **printed** permanent designations; punched for use with self-locking cable tie fastener.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. Grafoplast Wire Markers.
d. LEM Products Inc.
e. Marking Services Inc.
f. Panduit Corp.
g. Seton Identification Products; a Brady Corporation company.
h. emedco.

C. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. LEM Products Inc.
d. Pipemarker.com; Brimar Industries, Inc.
e. Seton Identification Products; a Brady Corporation company.

2. Polyester Tags: **0.010 inch (0.25 mm)** thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 SIGNS

A. Baked-Enamel Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Champion America.
    d. Marking Services Inc.
    e. emedco.

2. Preprinted aluminum signs, **high-intensity reflective,** punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4 inch (6.4 mm) grommets in corners for mounting.
4. Nominal Size: 7 by 10 inch (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Champion America.
    c. Marking Services Inc.
    d. emedco.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch (1 mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4 inch (6.4 mm) grommets in corners for mounting.
4. Nominal Size: 10 by 14 inch (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. Marking Services Inc.
    d. Seton Identification Products; a Brady Corporation company.
    e. emedco.

2. Engraved legend.
3. Thickness:

    a. For signs up to 20 sq. inch (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
    b. For signs larger than 20 sq. inch (129 sq. cm), 1/8 inch (3.2 mm) thick.
    c. Engraved legend with **black letters on white face** .
    d. **Punched or drilled for mechanical fasteners with 1/4 inch (6.4 mm) grommets in corners for mounting**.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services Inc.
4. Panduit Corp.

B. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN ZODZ; including UL 1565 or UL 62275.

C. UL ZODZ - General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

D. UL ZODZ - UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

E. UL ZODZ - Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 SELECTION OF COLORS AND IDENTIFICATION MARKINGS

A. Comply with 29 CFR 1910.144 for color identification of hazards, and the following:

1. Fire-protection **and fire-alarm** equipment**, including raceways,** must be finished, painted, or suitably marked safety red.
2. Ceiling-mounted hangers, supports, cable trays, and raceways must be finished, painted, or suitably marked safety yellow where less than **7.7 ft (2.3 m)** above finished floor.

B. Pipe and Conduit Labeling: Comply with ASME A13.1 **and IEEE C2**.

C. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded **service feeder and branch-circuit** conductors.

1. Color must be factory applied **or field applied for sizes larger than 6 AWG when permitted by authorities having jurisdiction**.
2. Colors for 208Y/120 V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Colors for 480Y/277 V Circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.

4. Color for Neutral (Grounded Conductor): **White or gray**.
5. Color for Equipment Ground: **Bare copper**, **Green** or **Green with yellow stripe**.

D. Color-Coding Raceways, Cable Trays, Junction Boxes, and Conductors for Intrinsically-Safe Circuits: Light blue. When used to identify intrinsically-safe circuits, Article 504 of NFPA 70 requires that the color light blue not be used for any other purpose.

E. Color-Coding Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.

F. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

G. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

H. Locations of Underground Lines: Underground-line warning tape for power and lighting.

I. Vaults, Manholes, Handholes, and Pull and Junction Boxes, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use **nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation**.

J. Accessible Raceways, Armored and Metal-Clad Cables, More Than 1000 V: **Vinyl wraparound labels, Snap-around labels** or **Self-adhesive labels**.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
2. Identify system voltage **and system or service type** with black letters on orange field.

K. Vaults, Manholes, Handholes, and Pull and Junction Boxes, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use **vinyl wraparound labels** to identify phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
2. Identify system voltage **and system or service type** with **black letters on orange field**.

L. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than **3**0 A and **120**V to Ground: Identify with self-adhesive **raceway labels**.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
2. Identify system voltage **and system or service type** with **black letters on orange field**.

M. Conductors to Be Extended in Future: Attach **write-on tags** or **marker tape** to conductors **and list source**.

N. Cover Plates: Label individual cover plates with self-adhesive labels. Place label at top of cover plate. Label cover plate with the following information, in the order listed:

1. Panelboard designation.
2. Colon or dash.
3. Branch circuit number.

O. Workspace Indication: Apply **floor marking tape or tape and stencil** to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

P. Equipment Identification Labels:

1. Black letters on white field.
2. Indoor Equipment: **Laminated acrylic or melamine plastic sign**.
3. Outdoor Equipment: **Laminated acrylic or melamine sign Stenciled legend 4 inch (100 mm) high**.
4. Equipment to Be Labeled:

   a. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels **containing equipment designation**.
   b. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of **self-adhesive, engraved,** laminated acrylic or melamine label.
   c. Enclosures and electrical cabinets.
   d. Access doors and panels for concealed electrical items.

e. Switchgear.
f. Switchboards.
g. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
h. Substations.
i. Emergency system boxes and enclosures.
j. Motor-control centers.
k. Enclosed switches.
l. Enclosed circuit breakers.
m. Enclosed controllers.
n. Variable-speed controllers.
o. Push-button stations.
p. Power-transfer equipment.
q. Contactors.
r. Remote-controlled switches, dimmer modules, and control devices.
s. Uninterruptible power supplies.
t. Battery-inverter units.
u. Battery racks.
v. Power-generating units.
w. Monitoring and control equipment.

Q. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 SELECTION OF SIGNS AND HAZARD MARKINGS

A. Comply with 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs.

B. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.
2. Facility Safety Signs: NEMA Z535.2.
3. Safety Symbols: NEMA Z535.3.
4. Product Safety Signs and Labels: NEMA Z535.4.
5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

C. Electrical Hazard Warnings:

1. Arc-Flash Hazard Warning: Self-adhesive labels. Comply with **NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis"** requirements for arc-flash hazard warning labels.
2. Raceways and Cables Carrying Circuits at More Than 1000 V:

   a. Black letters on orange field.
   b. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

3. Multiple Power Sources Warning Legend: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
4. OSHA Workspace Clearance Warning Legend: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: **Self-adhesive labels** or **Baked-enamel warning signs**.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

   a. Power-transfer switches.
   b. Controls with external control power connections.

E. Operating Instruction Signs: **Self-adhesive labels Baked-enamel warning signs**.

F. Emergency Operating Instruction Signs: **Self-adhesive labels Baked-enamel warning signs** with white legend on red background with minimum 3/8 inch (10 mm) high letters for emergency instructions at equipment used for **power transfer** and **load shedding**.

3.4 SELECTION OF IDENTIFICATION PRODUCTS FOR COMMUNICATIONS, CONTROL, AUXILIARY, AND LIFE SAFETY SYSTEMS

A. Comply with Section 270528 "Pathways for Communications Systems" and Section 271100 "Communications Equipment Room Fittings."

3.5 INSTALLATION

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes typical for electrical equipment environments specified in Section 260011 "Facility Performance Requirements for Electrical."

C. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

D. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

E. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

F. Install identifying devices before installing acoustical ceilings and similar concealment.

G. Verify identity of item before installing identification products.

H. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

I. Apply identification devices to surfaces that require finish after completing finish work.

J. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

M. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

O. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

P. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

Q. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

R. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

S. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

T. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.

U. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape not less than 12 inch (300 mm) directly above cables or raceways buried 18 inch (450 mm) or more below grade. Use multiple tapes where width of multiple lines installed in common trench [**or concrete envelope**]exceeds 16 inch (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

V. Concrete Cable Route Markers: **As indicated on Drawings**.

W. Metal Tags:

1. Place in location with high visibility and accessibility.
2. Secure using **general-purpose UV-stabilized plenum-rated** cable ties.

X. Nonmetallic Preprinted Tags:

1. Place in location with high visibility and accessibility.
2. Secure using **general-purpose UV-stabilized plenum-rated** cable ties.

Y. Write-on Tags:

1. Place in location with high visibility and accessibility.
2. Secure using **general-purpose UV-stabilized plenum-rated** cable ties.

Z. Baked-Enamel Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

AA. Metal-Backed Butyrate Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

BB. Laminated Acrylic or Melamine Plastic Signs: Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

END OF SECTION 260553

SECTION 260573

POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Short-circuit study.
2. Overcurrent protective device coordination study.
3. Load-flow and voltage-drop study.
4. Motor-starting study.
5. Arc-flash hazard study.
6. Digital-twin modeling.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional requirements applicable to coordinating, scheduling, and sequencing of the Work specified in this Section.

1.2 DEFINITIONS

A. Digital Twin: The digital representation of a real-world entity, concept, or notion, either physical or perceived.

1.3 ACTION SUBMITTALS

A. Product Data: For power system analysis software to be used for studies.

1. Product Certificates: For power system study software applications, include certificate stating compliance with specified requirements, signed by software manufacturer.

B. Power System Study Reports:

1. Submit reports after approval of system protective devices submittals. Submittals **must** be in digital form.
2. Submit short-circuit study input data, including completed computer-program input data sheets.
3. Submit coordination study input data, including completed computer-program input data sheets.

a. Submit load-flow, voltage-drop, and motor-starting data with coordination study.

4. Submit arc-flash study input data, including completed computer-program input data sheets.
5. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing,

obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

6. Submit revised one-line diagram, reflecting field investigation results and results of short-circuit study.

C. Data files for studies in format compatible with Owner's power system analysis software.

D. Digital-twin models.

1.4 QUALITY ASSURANCE

A. Submittals for power system studies must be signed and sealed by qualified electrical professional engineer responsible for their preparation.

B. Studies must be performed using commercially developed and distributed software designed specifically for power system analysis.

C. Software algorithms must comply with requirements of standards and guides specified in this Section.

D. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CYME International T&D Inc.; subsidiary of Eaton Corporation plc.
2. ETAP; brand of Operation Technology, Inc.; subsidiary of Schneider Electric.
3. EasyPower; brand of Bentley Systems, Inc.
4. Paladin DesignBase; brand of Bentley Systems, Inc.
5. Power Tools for Windows (PTW); brand of SKM Systems Analysis, Inc.

B. Standard Features:

1. Power System Analysis:

a. Power-systems-analysis software applications must have analytical capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 3002 series standards.
b. Computer software application must be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program must report device settings and ratings of overcurrent protective devices and must demonstrate selective coordination by computer-generated, time-current coordination plots.
c. Computer software application must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.

2. Analysis Standards:

a. Short-Circuit Current Analysis: In accordance with IEEE 3002.3.
b. Device Coordination Analysis: In accordance with IEEE 3004.3 and IEEE 3004.5.
c. Load-Flow Analysis: In accordance with IEEE 3002.2.
d. Motor-Starting Analysis: In accordance with IEEE 3002.7.
e. Harmonic Analysis: In accordance with IEEE 3002.8.
f. Transient Stability Analysis: In accordance with IEEE P3002.9.
g. Arc-Flash Hazard Analysis: In accordance with IEEE 1584.

3. Capable of printing arc-flash hazard warnings for equipment on [**polyester**] [**vinyl**], weather- and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E.

a. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard study:

1) Equipment designation.
2) Nominal voltage.
3) Protection boundaries.

a) Arc-flash boundary.
b) Restricted approach boundary.
c) Limited approach boundary.

4) Arc-flash PPE category.
5) Required minimum arc rating of PPE in Cal/cm squared.
6) Available incident energy.
7) Working distance.
8) Engineering report number, revision number, and issue date.

C. Other Available Features Required by the Project:

1. Simultaneous faults.
2. Explicit negative sequence.
3. Mutual coupling in zero sequence.
4. Digital-Twin Model: Ability to create a **cloud-based,** digital-twin model for life-cycle operation and maintenance of the facility's electrical power system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Collect and analyze data for power system studies.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call discrepancies to Architect's attention.
2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
3. For **relocated equipment and** equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.
4. Gather and tabulate required input data to support power system studies. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line

diagram. Comply with recommendations in IEEE 3002 series standards as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:

a. Product data for the Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
b. Electrical power utility impedance at service.
c. Power sources and ties.
d. Short-circuit current at each system bus (three phase and line to ground).
e. Full-load current of loads.
f. Voltage level at each bus.
g. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
h. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
i. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
j. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
k. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
l. Maximum demands from service meters.
m. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
n. Motor horsepower and NEMA MG 1 code letter designation.
o. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
p. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
q. Derating factors.

3.2 PREPARATION

A. Preparation of Data for Short-Circuit Study:

1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Architect's attention.
2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
3. Prepare one-line diagram of modeled power system, showing the following:

a. Protective device designations and ampere ratings.
b. Conductor types, sizes, and lengths.
c. Transformer kVA and voltage ratings.
d. Motor and generator designations and kVA ratings.
e. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
f. Derating factors and environmental conditions.
g. Revisions to electrical equipment required by study.

B. Preparation of Data for Overcurrent Protective Device Coordination Study:

1. Prepare data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, indicating the following:

   a. Special load considerations, including starting inrush currents and frequent starting and stopping.
   b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
   c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
   d. Generator thermal-damage curve.
   e. Ratings, types, and settings of utility company's overcurrent protective devices.
   f. Special overcurrent protective device settings or types stipulated by utility company.
   g. Time-current-characteristic curves of devices indicated to be coordinated.
   h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
   i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
   j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
   k. Identify series-rated interrupting devices for condition where available fault current is greater than interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

2. Examine the Project's overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
3. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

C. Preparation of Data for Arc-Flash Hazard Study:

1. Assemble data from short-circuit study and overcurrent protective device coordination study.
2. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.3 SHORT-CIRCUIT STUDY

A. Base study on device characteristics supplied by device manufacturer.

B. Extent of electrical power system to be studied is indicated on Drawings.

C. Begin short-circuit current analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 5 kA or less.

2. Exclude equipment supplied by single transformer smaller than 75 kVA.

D. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

E. Include AC fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase AC systems. Also account for fault-current DC decrement to address asymmetrical requirements of interrupting equipment.

F. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

G. Include in report identification of protective device applied outside its capacity.

3.4 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

A. Base study on device characteristics supplied by device manufacturer. **When analysis of full range of device is impractical, limiting scope of analysis from 10 to 100 percent of device range is acceptable.**

B. Begin analysis at service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 5 kA or less.

C. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

D. Transformer Primary Overcurrent Protective Devices:

1. Device must not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads in accordance with IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings must protect transformers in accordance with IEEE C57.12.00, for fault currents.

E. Motor Protection:

1. Select protection for low-voltage motors in accordance with IEEE 3004.8 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V in accordance with IEEE 620.

F. Conductor Protection: Protect cables against damage from fault currents in accordance with ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 3004.7. Demonstrate that equipment withstands maximum short-circuit current for time equivalent to tripping time of

primary relay protection or total clearing time of fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

G. Generator Protection: Select protection in accordance with manufacturer's published instructions and IEEE C37.102.

H. Include AC fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase AC systems. Also account for fault-current DC decrement, to address asymmetrical requirements of interrupting equipment.

I. Include coordination of ground-fault protection devices.

J. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at equipment indicated on one-line diagram.

1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.

K. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Application of series-rated devices must be recertified, complying with requirements in NFPA 70.
4. Include in report identification of protective device applied outside its capacity.

3.5 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform load-flow and voltage-drop study to determine steady-state loading profile of system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents.
2. Determine load flow and voltage drop based on 80 percent of design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.6 MOTOR-STARTING STUDY

A. Perform motor-starting study to analyze transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze effects of motor starting on power system stability.

B. Prepare motor-starting study report, noting light flicker for limits proposed by IEEE 1453, and voltage sags so as not to affect operation of other utilization equipment on system supplying motor.

3.7 ARC-FLASH HAZARD STUDY

A. Comply with NFPA 70E, including Annex D, for arc-flash hazard study.

B. Preparatory Studies: Obtain short-circuit study and overcurrent protective device coordination study results prior to starting arc-flash hazard study.

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current in accordance with NFPA 70E recommendations.

D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations**, except nominal arc-flash hazard warning data may be provided for equipment fed from transformers rated below 240 V(ac), 2000 A, instead of documenting precise calculations**.

F. Calculate limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must account for changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:

1. Fault contribution from induction motors must not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:

1. When circuit breaker is in separate enclosure.
2. When line terminals of circuit breaker are separate from work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.8 POWER SYSTEM STUDY REPORTS

A. Preparation of Power System Study Reports: Prepare and submit the following:

1. Short-Circuit Study Report Contents:

a. Executive summary of study findings.

b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
c. One-line diagram of modeled power system, showing the following:

1) Protective device designations and ampere ratings.
2) Conductor types, sizes, and lengths.
3) Transformer kVA and voltage ratings.
4) Motor and generator designations and kVA ratings.
5) Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6) Derating factors and environmental conditions.
7) Revisions to electrical equipment required by study.

d. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.
e. Short-Circuit Study Input Data:

1) One-line diagram of system being studied.
2) Power sources available.
3) Manufacturer, model, and interrupting rating of protective devices.
4) Conductors.
5) Transformer data.

f. Protective Device Evaluation:

1) Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2) Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3) For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4) For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5) Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

g. Short-Circuit Study Output Reports:

1) Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a) Voltage.
b) Calculated fault-current magnitude and angle.
c) Fault-point X/R ratio.
d) Equivalent impedance.

2) Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a) Voltage.

b) Calculated symmetrical fault-current magnitude and angle.
c) Fault-point X/R ratio.
d) Calculated asymmetrical fault currents based on fault-point X/R ratio; based on calculated symmetrical value multiplied by 1.6; and based on calculated symmetrical value multiplied by 2.7.

3) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a) Voltage.
b) Calculated symmetrical fault-current magnitude and angle.
c) Fault-point X/R ratio.
d) No AC Decrement (NACD) ratio.
e) Equivalent impedance.
f) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
g) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

2. Overcurrent Protection Device Coordination Study Report Contents:

a. Executive summary of study findings.
b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
c. One-line diagram of modeled power system, showing the following:

1) Protective device designations and ampere ratings.
2) Conductor types, sizes, and lengths.
3) Transformer kVA and voltage ratings.
4) Motor and generator designations and kVA ratings.
5) Switchgear, switchboard, motor-control center, and panelboard designations.
6) Revisions to electrical equipment required by study.

d. Report recommended settings of protective devices, ready to be applied in field. Use manufacturer's data sheets for recording recommended setting of overcurrent protective devices when available.

1) Phase and Ground Relays:

a) Device tag.
b) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
c) Recommendations on improved relaying systems, if applicable.

2) Circuit Breakers:

a) Adjustable pickups and time delays (long time, short time, and ground).
b) Adjustable time-current characteristic.
c) Adjustable instantaneous pickup.
d) Recommendations on improved trip systems, if applicable.

3) Fuses: Show current rating, voltage, and class.

e. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for switching schemes and for emergency periods where power source is local generation. Show the following information:

1) Device tag and title, one-line diagram with legend identifying portion of system covered.
2) Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
3) Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4) Plot the following listed characteristic curves, as applicable:

a) Power utility's overcurrent protective device.
b) Medium-voltage equipment overcurrent relays.
c) Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d) Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e) Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f) Cables and conductors damage curves.
g) Ground-fault protective devices.
h) Motor-starting characteristics and motor damage points.
i) Generator short-circuit decrement curve and generator damage point.
j) Largest feeder circuit breaker in each motor-control center and panelboard.

5) Maintain selectivity for tripping currents caused by overloads.
6) Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7) Provide adequate time margins between device characteristics such that selective operation is achieved.
8) Comments and recommendations for system improvements.

3. Arc-Flash Hazard Study Report Contents:

a. Executive summary of study findings.
b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
c. One-line diagram, showing the following:

1) Protective device designations and ampere ratings.
2) Conductor types, sizes, and lengths.
3) Transformer kVA and voltage ratings, including derating factors and environmental conditions.
4) Motor and generator designations and kVA ratings.
5) Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

d. Short-circuit study output data.
e. Overcurrent protective device coordination study report contents.
f. Arc-Flash Study Output Reports:

1) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:

   a) Voltage.
   b) Calculated symmetrical fault-current magnitude and angle.
   c) Fault-point X/R ratio.
   d) No AC Decrement (NACD) ratio.
   e) Equivalent impedance.
   f) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
   g) Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

g. Incident Energy and Flash Protection Boundary Calculations:

   1) Arcing fault magnitude.
   2) Protective device clearing time.
   3) Duration of arc.
   4) Arc-flash boundary.
   5) Restricted approach boundary.
   6) Limited approach boundary.
   7) Working distance.
   8) Incident energy.
   9) Hazard risk category.
   10) Recommendations for arc-flash energy reduction.

h. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

3.9 DIGITAL-TWIN MODELING

A. **Create cloud-based,** digital-twin model of as-constructed facility's electrical power system.

3.10 FIELD ADJUSTMENT FOR DEVICE COORDINATION

A. Adjust relay and protective device settings in accordance with recommended settings provided by coordination study. Field adjustments must be completed by engineering service division of equipment manufacturer under "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with **short-circuit and** protective device coordination studies.

C. Testing and adjusting must be by qualified **medium-voltage and** low-voltage electrical testing and inspecting agency.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for adjustable overcurrent protective devices.

3.11 WARNING LABELING OF ARC-FLASH HAZARDS

A. Apply **one** arc-flash label on front cover **of each section of equipment and on side or rear covers with accessible live parts and hinged doors or removable plates** for each equipment included in study, including each piece of equipment listed below:

1. Medium-voltage switchgear.
2. Medium-voltage switches.
3. Medium voltage transformers.
4. Low-voltage switchgear.
5. Switchboards.
6. Panelboards.
7. Motor-control centers.
8. Low voltage transformers.
9. Safety switches.
10. Control panels.

B. Base arc-flash label data on highest values calculated at each location.

C. Machine print warning labels with no handwritten or field-applied markings.

D. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

E. Indicate on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

END OF SECTION 260573

SECTION 260800

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical equipment connected to Normal electrical systems, including the following:

   a. Motor-control centers.
   b. Transformers.
   c. **Primary and secondary** service electrical systems.
   d. **Distribution and branch-circuit** panelboards.
   e. Lightning protection systems.
   f. Grounding systems.

2. Electrical equipment connected to Essential electrical systems that provide an alternative source of power in the absence of power from the Normal electrical system, including the following:

   a. Motor-control centers.
   b. **Primary and secondary** service electrical systems.
   c. **Distribution and branch-circuit** panelboards.
   d. Lighting protection systems.
   e. Grounding systems.
   f. Generators.
   g. UPS.

3. Controls and instrumentation, including the following:

   a. Equipment monitoring systems.
   b. Energy monitoring and control systems.
   c. Electrical metering and metering system.
   d. Demand response systems.
   e. Lighting control systems.
   f. Security systems.
   g. Fire-alarm systems.

4. Systems testing and verification, including **Normal and Essential** electrical systems**, and transitions from Normal to Essential electrical systems and back**.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

3. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

A. BoD: Basis-of-Design Document, as defined in Section 019113 "General Commissioning Requirements."

B. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."

C. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."

D. OPR: Owner's Project Requirements, as defined in Section 019113 "General Commissioning Requirements."

E. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Construction Checklists by CxA: Draft construction checklists will be created by CxA for Contractor review.

B. Construction Checklists by Contractor: Include the following and comply with requirements in Section 019113 "General Commissioning Requirements" for construction checklists:

1. Instrumentation and control for electrical systems.
2. Instrumentation and control for lighting control systems.
3. Low-voltage power cables.
4. Control voltage power cables.
5. Electrical feeders and branch circuits.
6. Liquid-filled transformers.
7. Dry-type transformers.
8. Instrument transformers.
9. Switchgear and switchboard assemblies rated 1200 A or greater.
10. Metal-enclosed bus duct.
11. Busway.
12. Motor-control centers.
13. Low-voltage motor starters.
14. Low-voltage air circuit breakers.
15. Low-voltage insulated case circuit breakers.
16. Low-voltage network protectors.
17. Low-voltage air switches.
18. Low-voltage surge protective devices.
19. Medium-voltage power cables.
20. Medium-voltage circuit breakers.
21. Medium-voltage motor starters.
22. Medium-voltage air circuit breakers.
23. Medium-voltage vacuum circuit breakers.
24. Medium-voltage SF6 (sulfur hexafluoride) circuit breakers.
25. Medium-voltage air switches.

26. Medium-voltage surge protective devices.
27. Protective relays.
28. Metering devices.
29. Molded-case circuit breakers.
30. Low-voltage power circuit breakers.
31. Grounding systems.
32. Ground-fault protection systems.
33. Panelboards.
34. Receptacles and devices.
35. Engine generators.
36. Automatic transfer switches.
37. Variable-frequency drives.
38. AC synchronous motors and generators.
39. AC induction motors and generators.
40. DC motors and generators.
41. Battery systems.
42. Battery chargers.
43. Flooded lead-acid batteries.
44. Flooded lead-calcium batteries.
45. VRLA batteries.
46. UPS systems.
47. Power factor correction equipment, including capacitors, dry-type reactors (both shunt and current-limiting), and liquid-filled reactors (both shunt and current-limiting).
48. Lighting.
49. Vehicle charging equipment.

1.4 QUALITY ASSURANCE

A. Testing Equipment and Instrumentation Quality and Calibration: For test equipment and instrumentation required to perform electrical Cx work, perform the following:

1. Submit test equipment and instrumentation list. For each equipment or instrument, identify the following:

    a. Equipment/instrument identification number.
    b. Planned Cx application or use.
    c. Manufacturer, make, model, and serial number.
    d. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.

2. Test equipment and instrumentation must meet the following criteria:

    a. Capable of testing and measuring performance within the specified acceptance criteria.
    b. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
    c. Be maintained in good repair and operating condition throughout duration of use on Project.
    d. Be recalibrated/repaired if dropped or damaged in any way since last calibrated.

B. Proprietary Test Instrumentation and Tools:

1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, perform the following:

    a. Submit proprietary instrumentation and tools list. For each instrument or tool, identify the following:

        1) Instrument or tool identification number.
        2) Equipment schedule designation of equipment for which the instrument or tool is required.
        3) Manufacturer, make, model, and serial number.
        4) Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

    b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
    c. Electrical proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION CHECKLISTS

A. Prepare detailed construction checklists for electrical systems, subsystems, equipment, and components. Complete and submit construction checklists.

3.2 CONSTRUCTION CHECKLIST REVIEW

A. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.

B. Return draft Construction Checklist review comments within [**10**] <**Insert number**> days of receipt.

C. When review comments have been resolved, CxA will provide final construction checklists, marked "Approved for Use, (date)."

D. Use only construction checklists, marked "Approved for Use, (date)."

3.3 GENERAL TESTING REQUIREMENTS

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved Shop Drawings and submittals.

B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions to verify compliance with acceptance criteria.

E. Test systems, assemblies, subsystems, equipment, and components operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and response according to acceptance criteria.

F. Construction Checklists: Prepare and submit detailed construction checklists for electrical systems, subsystems, equipment, and components.

1. Contributors to development of construction checklists must include, but are not limited to, the following:

a. Electrical systems and equipment installers.
b. Electrical instrumentation and controls installers.

G. Perform tests using design conditions, whenever possible.

1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.

H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

I. If seasonal testing is specified, complete appropriate initial performance tests and documentation and schedule seasonal tests.

J. Coordinate schedule with, and perform Cx activities at the direction of the CxA.

K. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance tests requirements specified in Sections specifying electrical systems and equipment.

L. Provide qualified testing and inspecting agency personnel in accordance with Section 260010 "Supplemental Requirements for Electrical," instrumentation, tools, and equipment to complete and document the following:

1. Performance tests.

2. Demonstration of a sample of performance tests.
3. Cx tests.
4. Cx test demonstrations.

3.4 Cx TESTS FOR ELECTRICAL SYSTEMS

A. Verification of Normal Electrical System Operation:

1. Prerequisites: Acceptance of results for construction checklists for Division 26 electrical components associated with Normal electrical system.
2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Normal electrical system.
4. Test Conditions: Energize components of Normal electrical system, one at a time.
5. Acceptance Criteria: Proper operation of Normal electrical system over a [**24**] [**48**] <**Insert number**>-hour period.

B. Verification of Essential Electrical System Operation:

1. Prerequisites:

   a. Acceptance of results for construction checklists for Division 26 electrical components associated with Essential electrical system.
   b. Completion of "Verification of Normal Electrical System Operation" tests.

2. Equipment and Systems to Be Tested: Division 26 electrical equipment.
3. Test Purpose: Verify operation of Essential electrical system.
4. Test Conditions:

   a. Energize components of Normal electrical system.
   b. Simulate a failure of Normal electrical system.

5. Acceptance Criteria: Transfer of power from Normal to Essential electrical system within OPR.

C. Verification of Control and Instrumentation:

1. Prerequisites: Acceptance of results for construction checklists.

   a. Section 260913 "Electrical Power Monitoring and Control."
   b. Section 260926 "Lighting Control Panelboards."
   c. Section 260936 "Modular Dimming Controls."
   d. Section 260943.16 "Addressable-Luminaire Lighting Controls."
   e. Section 260943.23 "Relay-Based Lighting Controls."
   f. Section 262713 "Electricity Metering."
   g. Section 263533 "Power Factor Correction Equipment."

D. Test Purpose: Verify operation of control and monitoring systems for Normal and Essential electrical systems.

E. Test Conditions:

1. Energize components of Normal electrical system.
2. Test operation of equipment.

F. Acceptance Criteria: Operation of equipment according to OPR.

END OF SECTION 260800

SECTION 260913

ELECTRICAL POWER MONITORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multifunction energy meters.
2. Power meters.
3. Circuit meters and monitors.
4. Circuit meter and explorer.
5. PC operating system software.
6. Networked PC operating system software.
7. Power monitoring and control software.
8. Network configuration software.
9. Monitoring and control of power distribution equipment.
10. System operator interfaces.
11. Desktop workstations.
12. Portable workstations.
13. Raceways and boxes.
14. Wires and cables.
15. Surge protection devices.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

A. Active Power: The average power consumed by a unit. Also known as "real power."

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. Apparent (Phasor) Power: "S = VI" where "S" is the apparent power, "V" is the RMS value of the voltage, and "I" is the RMS value of the current.

D. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.

E. KY Pulse: A method of measuring consumption of electricity that is based on a relay operating like a SPST switch.

F. KYZ Pulse: A method of measuring consumption of electricity based on a relay operating like a SPDT switch.

G. L-G: Line to ground.

H. L-L: Line to line.

I. L-N: Line to neutral.

J. MODBUS TCP/IP: An open protocol for exchange of process data.

K. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

L. N-G: Neutral to ground.

M. Power Factor: The ratio of active power to apparent power, sometimes expressed in percentage.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Multifunction energy meters.
2. Power meters.
3. Circuit meters and monitors.
4. Circuit meter and explorer.
5. PC operating system software.
6. Networked PC operating system software.
7. Power monitoring and control software.
8. Network configuration software.
9. Monitoring and control of power distribution equipment.
10. System operator interfaces.
11. Desktop workstations.
12. Portable workstations.
13. Raceways and boxes.
14. Wires and cables.
15. Surge protection devices.

B. Shop Drawings: For power monitoring and control equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, method of field assembly, components, and location and size of each field connection.

a. Attach copies of approved Product Data submittals for products (such as switchboards, switchgear, and motor-control centers) that describe the following:

1) Location of the meters and gateways, and routing of the connecting wiring.
2) Details of power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.

3. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
4. Network naming and numbering scheme.
5. Include diagrams for power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
6. Specifications for workstations.
7. UPS sizing calculations for workstation.
8. Surge Suppressors: Data for each device used and where applied.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Design Data:

1. Manufacturer's system installation and setup guides, with data forms to plan and record options and setup decisions.

    a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format on compact disk or portable storage device with a USB interface.
    b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
    c. As-built versions of submittal Product Data.
    d. Names, addresses, e-mail addresses, and 24-hour telephone numbers of Installer and service representatives for the system and products.
    e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
    f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
    g. Engineering, installation, and maintenance manuals that explain how to do the following:

        1) Design and install new points, panels, and other hardware.
        2) Perform preventive maintenance and calibration.
        3) Debug hardware problems.
        4) Repair or replace hardware.

    h. Documentation of programs created using custom programming language including set points, tuning parameters, and object database.
    i. Backup copy of graphic files, programs, and database on compact disk or portable storage device with a USB interface.
    j. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
    k. Complete original-issue copies of furnished software, including operating systems, custom programming language, workstation software, and graphics software on compact disk or portable storage device with a USB interface.
    l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

m. Owner training materials.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Addressable Relays: One for every **10** installed. Furnish at least one of each type.
2. Data Line Surge Suppressors: One for every **10** of each type installed. Furnish at least one of each type.

1.6 COORDINATION

A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of specified functions.

B. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control of electrical power distribution system(s) that includes the following:

1. Electrical meters that monitor, control, and connect to the data transmission network.
2. LAN: High-speed, multi-access, open, nonproprietary, industry-standard communication protocols.
3. Include **PC-based workstation with web access**, with its operating system and application software, connected to data transmission network.

B. The electrical power monitoring and control system must be Internet based.

1. System software must be based on server thin-client architecture, designed around open standards of internet technology.
2. Intent of thin-client architecture is to provide operators complete access to power monitoring and control system via an Internet browser. No special software other than an Internet browser must be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
3. Internet access must be password protected.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with UL 61010-1 and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Protection: For external wiring of each conductor entry connection to components to protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads.

1. Minimum Protection for Power Lines 120 V and More: **SPDs complying with UL 1449, listed and labeled for intended use by an NRTL acceptable to authorities having jurisdiction.**
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements as recommended by manufacturer for type of line being protected.

B. Addressable Devices: Transmitters and receivers must communicate unique device identification and status reports to monitoring and control clients.

C. Interface with DDC System for HVAC: Provide factory-installed hardware and software to enable the DDC system for HVAC to monitor, display, and record data for use in processing reports.

1. Hardwired Monitoring Points: Electrical power demand (kilowatts), electrical power consumption (kilowatt-hours)**, power factor**.
2. [**ASHRAE 135 (BACnet)**] [**ISO/IEC 14908-1 (LonTalk)**] [**MODBUS Application Protocol Specification**] [**Industry-accepted, open-protocol**] **<Insert type of interface>** communication interface with the DDC system for HVAC must enable the DDC system for HVAC operator to remotely monitor meter information from a DDC system for HVAC workstation. Control features and monitoring points displayed locally at metering panel must be available through the DDC system for HVAC.

D. Backup Power Source:

1. Electrical power distribution equipment served by a backup power source for controls must have associated power monitoring and control system products that monitor and control such systems and equipment also served from a backup power source.

2.3 MULTIFUNCTION ENERGY METERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. GE Power; General Electric Company.
3. Leviton Manufacturing Co., Inc.
4. Schneider Electric USA, Inc.

B. Multifunction Energy Meter: Separately mounted, modular, permanently installed, solid-state, digital I/O instrument for power and energy metering and monitoring; complying with UL 61010-1.

1. Capable of metering four-wire wye, three-wire wye, three-wire delta, and single-phase power systems.
2. Equipped with security lock to protect revenue related metering from unauthorized and accidental changes.

C. Comply with IEC 60529 degree of protection code of IP65 for the front of the meter, and code of IP30 for the body.

D. Overvoltage: Comply with UL 61010-1 overvoltage withstand rating for CAT III.

E. Accuracy:

1. Comply with ANSI C12.20, Class 0.5.
2. Neutral Current Measurement: Not more than 0.65 percent.
3. Power Factor: 1.0 percent.
4. Frequency: 0.1 percent.
5. THD: 1.0 percent.
6. Waveform Sampling: 64 per cycle.

F. Data Link:

1. MODBUS TIA-485, RTU protocol, compliant wire connection to host devices with a compatible port.

>

G. Meter Physical Characteristics:

1. Display: Backlit LCD with antiglare and scratch-resistant lens.
2. Display of Metered Values:

a. One screen to show at least **three** user-selected values displayed at the same time. Selections available to display must include the following:

1) Meters.
2) Measurements.
3) THD.
4) Energy.
5) Demand.
6) Minimum and maximum values.
7) Power demand.

H. Sampling Rate: Continuously sample and record voltage and current at a rate not less than **64** samples per cycle, simultaneously on voltage and current channels of the meter.

I. Meters:

1. Instantaneous, RMS:

a. Current: Each phase, **neutral** and three-phase average.
b. Voltage: L-L each phase, L-L three-phase average, L-N each phase, and L-N three-phase average.
c. Active Power (kW): **Each phase and** three-phase total.
d. Reactive Power (kVAR): **Each phase and** three-phase total.
e. Apparent Power (kVA): **Each phase and** three-phase total.
f. Power Factor: **Each phase and** three-phase total.

2. Energy:

a. Active Energy (kWh): Three-phase total.

3. Demand, Derived from Instantaneous RMS Meters:

    a. Current: Present and maximum.
    b. Active: Present and maximum.
    c. Reactive: Present and maximum.
    d. Apparent: Present and maximum.

4. Power Quality Measurements:

    a. THD: Current and voltage from measurements simultaneously from the same cycle, as can be calculated from the specified sampling rate.

J. I/O: Two optically isolated digital outputs for KY pulsing or control. Output signal characteristics must be 150 mA at 200 V.

1. KY Pulse: Generate standard KY pulses for a user-defined increment of metered active energy as follows:

    a. User-defined pulse output, associated with kWh.
    b. User-defined pulse output, associated with kVARh.

K. Capacities and Characteristics:

1. Power Supply: 1**20 V(ac), 60 Hz**.
2. Circuit Connections:

    a. Voltage: Measurement autoranging, 60 to 400 V(ac) L-N. **Connect directly to low-voltage (600 V and less) without using voltage transformers.** Meter impedance must be 2 megohm L-L or greater. Overload Tolerance: 1500 V(ac), RMS, continuously.
    b. Current: Connect to instrument grade current transformer with a metering range of 5 mA to 6 A. Overcurrent tolerance of the instrument must be 10 A continuous, 50 A for 10 seconds once per hour, and 120 A for one second per hour.
    c. Frequency: 45 to 65 Hz.
    d. Time: Input from a GPS receiver to synchronize the internal clock of the instrument and to time-synchronize this instrument with the network to a deviation of not greater than 1 ms.

2.4 POWER METERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. GE Power; General Electric Company.
3. Leviton Manufacturing Co., Inc.
4. Schneider Electric USA, Inc.
5. Siemens Industry, Inc., Energy Management Division.

B. Description: Separately mounted, modular, permanently installed, solid-state, digital I/O instrument for power monitoring and control; complying with UL 61010-1.

1. Capable of metering four-wire wye, three-wire wye, three-wire delta, and single-phase power systems.

2. Equipped with security lock to protect revenue related metering from unauthorized and accidental changes.

C. Comply with IEC 60529 degree of protection code of IP51 for the front of the meter, and code of IP30 for the body.

D. Overvoltage: Comply with UL 61010-1 overvoltage withstand rating for CAT III.

E. Accuracy:

1. Comply with ANSI C12.20, Class 0.5.
2. Neutral Current Measurement: Not more than 0.65 percent.
3. Power: 0.6 percent.
4. Power Factor: 0.5 percent.
5. Active Energy: 0.6 percent.
6. Reactive Energy: 2.5 percent.
7. Frequency: 0.05 percent.
8. THD: 1.0 percent.
9. Waveform Sampling: 32 per cycle.

F. Data Link:

1. MODBUS TIA-485 RTU protocol, device compliant -wire connection.

a. Provide for firmware and software updates through the communications port.

G. Meter Physical Characteristics:

1. Display: Backlit LCD with antiglare and scratch-resistant lens.
2. Display of Metered Values: One screen to show at least **four** lines of user-selected values on one screen at the same time. Provide graphical representation of user-selected values. The screen selections available at the display must include the following:

a. Meters, including those listed under the following:

1) Measurements.
2) THD.
3) Energy.
4) Demand.
5) Minimum and maximum values.
6) Power demand.

H. Sampling Rate: Continuously sample and record voltage and current at a rate not less than **32 samples per cycle**, simultaneously on voltage and current channels of the meter.

I. Meters:

1. Measurements: Instantaneous, in real time, RMS to the 15th harmonic.

a. Voltage: L-L each phase, L-N each phase, and three-phase average.
b. Current: Each phase, three-phase average, and neutral.
c. Unbalanced current, L-L V(ac) and L-N V(ac).
d. Active Power (+/- kW): Each phase and three-phase total.
e. Reactive Power (+/- kVAR): Each phase and three-phase total.
f. Apparent Power (+/- kVA): Each phase and three-phase total.

g. Displacement Power Factor: Each phase and three-phase total.
h. Distortion Power Factor: Each phase and three-phase total.
i. Frequency.

2. THD from measurements simultaneously from the same cycle, through **15th** harmonic.

a. Voltage THD: L-L each phase, L-N each phase, and three-phase average.
b. Current THD: Each phase and three-phase average.
c. Total demand distortion.

3. Energy: Accumulated, indicate whether in-flow or out-flow, net and absolute values. Store the values in instrument's nonvolatile memory.

a. Active kWh.
b. Reactive kVARh.
c. Apparent kVAh.

4. Demand: Present, last, predicted, peak.

a. Three-phase average current.
b. Three-phase total active power (kW).
c. Reactive power (kVAR).
d. Apparent power (kVA).

5. Minimum and Maximum Values:

a. L-L and L-N voltages.
b. Current in each phase.
c. Power factor.
d. Active power total.
e. Reactive power total.
f. Apparent power total.
g. THD L-L and L-N voltages.
h. THD current in each phase.
i. Frequency.

J. Power Demand, User Selectable:

1. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
2. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:

a. Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
b. Fixed block that calculates demand at end of the interval.
c. Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.

3. Demand Calculation Initiated by a Synchronization Signal:

a. Signal is a pulse from an external source. Demand period begins with every pulse. Calculation must be configurable as either a block or rolling block calculation.

b. Signal is a communication signal. Calculation must be configurable as either a block or rolling block calculation.
c. Provide for synchronizing the demand with the internal of this instrument.

K. Data Recording: Store the listed values in instrument's nonvolatile memory, indicate which of the three phases relates to the value. Attach a date and time stamp to the peak values and the alarms.

1. Minimum and maximum of real-time RMS measurement.
2. Energy.
3. Demand values.
4. Alarms, store the last 40 events.

L. Alarms: Transmit a digital output and show on display when alarmed. Provide for no fewer than **15** metered items. Each alarm must be user configured, by using the following options:

1. Date and time stamp.
2. Enable-disable (default) or enable.
3. Pickup magnitude.
4. Pickup time delay.
5. Dropout magnitude.
6. Dropout time delay.
7. Alarm type.
8. Alarm label.

M. Output Signals: Provide two mechanical relays, rated not less than 250 V(ac), 2 A resistive, and rated for 200,000 cycles or more. The relays must be user configurable in one of the following listed modes:

1. Normal contact closure where the contacts change state for as long as the signal exists.
2. Latched mode when the contacts change state when a pickup signal is received and are held until a dropout signal is received.
3. Timed mode when the contacts change state when a pickup signal is received and are held for a preprogrammed duration.

N. Meter Face:

1. Display: Backlit LCD display, six lines, with antiglare and scratch-resistant lens.
2. Display of Metered Values: One screen to show at least [**four**] <**Insert number**> user-selected values on one screen at the same time.
3. Provide for the reset of metered peak values.

O. Capacities and Characteristics:

1. Power Supply: **120 V(ac), 60 Hz**.
2. Circuit Connections:

a. Voltage: Measurements autoranging, 60 to 400 V(ac) L-N. **Connect directly to low-voltage (600 V and less) without using voltage transformers.** Meter impedance must be 2 megohm L-L or greater. Overload Tolerance: 1500 V(ac), RMS, continuously.
b. Current: Connect to instrument grade current transformer with a metering range of 5 mA to 6 A. Overcurrent tolerance of the instrument must be 10 A continuous, 50 A for 10 seconds once per hour, and 120 A for one second per hour.
c. Frequency: 45 to 65 Hz.

d. Time: Input from a GPS receiver to synchronize the internal clock of the instrument and to time-synchronize this instrument with the network to a deviation of not greater than 1 ms.

2.5 CIRCUIT METERS AND MONITORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. GE Power; General Electric Company.
3. Schneider Electric USA, Inc.
4. Siemens Industry, Inc., Energy Management Division.

B. Description: Separately mounted, modular, permanently installed, solid-state, digital I/O instrument for power monitoring and control; complying with UL 61010-1. Capable of metering four-wire wye, three-wire wye, three-wire delta, and single-phase power systems.

1. Equipped with security lock to protect revenue related metering from unauthorized and accidental changes.

C. Comply with IEC 60529 degree of protection code of IP52 for the front of the meter, and code of IP30 for the back.

D. Overvoltage: Comply with UL 61010-1 overvoltage withstand rating for CAT III.

E. Accuracy:

1. Comply with ANSI C12.20, Class 0.5.
2. For Voltage and Current: 0.5 percent of reading.
3. For Active Power: 0.2 percent.
4. For Active and Reactive Energy: ANSI 12.20, Class 0.2.
5. For Frequency: 0.01 Hz in the range of 45 to 65 Hz.
6. For Power Factor: 0.2 percent from 0.5 leading to 0.5 lagging.

F. Data Links:

1. MODBUS TIA-485 RTU protocol, meter compliant wire connection.
2. MODBUS TIA-232/TIA-485 RTU/ASCII protocol, compliant wire connection.
3. MODBUS TCP:

a. 10/100BaseTX balanced twisted pair cabling. 8PSJ connector, 100 m link.
b. Optical fiber 100BaseFX, LC duplex connector, 1300 m link. Multimode 62.5/125 microsecond, 2000 m link.

4. Provide for firmware and software updates through the communications port.
5. Ethernet 10/100BaseTX balanced twisted pair cabling and MODBUS TIA-485 serial master port.
6. Ethernet 10/100BaseTX balanced twisted pair cabling and MODBUS TIA-485 serial master port, Ethernet to serial line gateway, and embedded web server.

G. Meter Physical Characteristics:

1. Display: Backlit LCD screen with antiglare and scratch-resistant lens.

2. Display of Metered Values: One screen to show at least **four** lines of user-selected values on one screen at the same time. Provide graphical representation of user-selected values.
3. Allow user to select a date/time format and the ability to create additional screens for user-specified views and custom quantities without overwriting existing standard screens.

H. Sampling Rate:

1. Continuously sample and record voltage and current at a rate not less than **128 samples per cycle**, simultaneously on voltage and current channels of the meter.

I. Meters must measure, record with time stamp, calculate, and on request display the following:

1. Measurements: Instantaneous, in real time, RMS to the **31st** harmonic:

a. Voltage: L-L each phase, L-L three-phase average, L-N each phase, and L-N three-phase average.
b. Current: Each phase, three-phase average, and neutral.
c. Active Power (kW): Each phase and three-phase total.
d. Reactive Power (kVAR): Each phase and three-phase total.
e. Apparent Power (kVA): Each phase and three-phase total.
f. Displacement Power Factor: Each phase and three-phase total.
g. Distortion Power Factor: Each phase and three-phase total.
h. Frequency.

2. THD from measurements simultaneously from the same cycle, through **31st** harmonic:

a. Voltage: L-L each phase, L-L three-phase average, L-N each phase, and L-N three-phase average.
b. Current: Each phase, three-phase average, and neutral.

3. Energy: Accumulated, indicate in-flow or out-flow, net and absolute values. Store the values in instrument's nonvolatile memory. Provide for storing accumulated energy at user-defined intervals, up to three intervals per day.

a. Active kWh.
b. Reactive kVARh.
c. Apparent kVAh.

4. Demand: Three-phase totals, present, predicted, peak.

a. Average current.
b. Active power (kW).
c. Reactive power (kVAR).
d. Apparent power (kVA).

5. Average, Minimum and Maximum Values:

a. Record, date and time stamp, and save the minimum and maximum values of RMS metered values since the last reset.

J. Power Demand, User Selectable:

1. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
2. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:

    a. Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
    b. Fixed block that calculates demand at end of the interval.
    c. Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.

3. Demand Calculation Initiated by a Synchronization Signal:

    a. Synchronize demand with receipt of a signal pulse from an external source. Demand period begins with every pulse. Calculation must be configurable as either a block or rolling block calculation.
    b. Synchronize demand with receipt of a communication signal. Calculation must be configurable as either a block or rolling block calculation.
    c. Provide for synchronization to the clock in the instrument.

K. Trend Curves: Provide for recording four trend curves at intervals of one minute, one hour, one day, or one month; and forecast values for the trended parameters.

1. Record minimum, maximum, and average values of eight user-selected parameters as follows:

    a. Every second for one minute for the one-minute curve.
    b. Every minute for one hour for the one-hour curve.
    c. Every hour for one day for the one-day curve.
    d. Every day for one month for the one-month curve.

2. Forecast the trended parameters for the following:

    a. The next four hours.
    b. The next four days.

L. Waveform Capture:

1. Steady State Waveform Capture: Manually initiated.

    a. Capture, record with time stamp, and store voltage and current waveforms for two cycles.
    b. Capture, record with time stamp, and store 128 digitally sampled data points for each cycle of each phase voltage. The number of waveform captures stored onboard must be user configurable.
    c. Harmonic analysis performed on the captured waveforms must resolve harmonics through the 63rd.
    d. Captured waveforms must be recorded from actual circuit performance.

2. Disturbance Waveform Capture:

    a. Capture, record with time stamp, and store 128 digitally sampled data points for each cycle of each phase voltage. Disturbance waveform capture may be initiated manually, by an external contact closure, or by an alarm. The waveform captures

must be user configurable from 185 cycles on 1 channel at 16 points per cycle, to 3 cycles on 6 channels at 128 points per cycle.

M. Disturbance Detection and Alarm:

1. Detect and initiate alarm when detecting voltage or current sag and swell.

    a. Detect disturbance events of less than half-cycle in length, by monitoring and calculating RMS magnitude of each half-cycle.
    b. Event detection must be with user-defined parameters of threshold and delay. The threshold must be user defined as a fixed or relative set point. With relative set point, the instrument will alarm based on the nominal current or voltage equal to its present average value. The instrument must automatically adjust the nominal current and voltage values to avoid nuisance alarms caused by gradual daily variations of currents and voltages.
    c. When detecting an alarm condition:

        1) Initiate disturbance waveform capture.
        2) Record the disturbance parameters into an onboard alarm log with a date and time stamp to the millisecond.
        3) Alarm on must be visible on the display and be transmitted over the data link.
        4) Display the voltage sag/swell events on ITIC or SEMI graphs to quantify the event for accepted industry standards.

N. Harmonics Information:

1. Calculate the harmonic magnitudes and angles for each phase voltage and current through the 63rd harmonic. Provide harmonic power flows up to the 41st harmonic for active, reactive, and apparent power.
2. The current and voltage information for phases must be obtained simultaneously from the same cycle.
3. Report harmonic information as a percentage of the fundamental or as a percentage of the RMS values, as selected by the user.

O. Alarms: Alarm events must be user definable. Provide a minimum of 40 user-defined alarm conditions.

1. User Configuration Options:

    a. Date and time stamp.
    b. Enable-disable (default) or enable.
    c. Pickup magnitude.
    d. Pickup time delay.
    e. Dropout magnitude.
    f. Dropout time delay.
    g. Alarm type.
    h. Alarm label.

2. The following classes of events must be available to be programmed as alarm events:

    a. Over/under current.
    b. Over/undervoltage.
    c. Current imbalance.
    d. Phase loss, current.

e. Phase loss, voltage.
f. Voltage imbalance.
g. Over kVA.
h. Over kW or kVAR into/out of load.
i. Over/under frequency.
j. Under power factor, true or displacement.
k. Over THD.
l. Over demand, current or power.
m. Reverse power.
n. Phase reversal.
o. Status input change.
p. End of incremental energy interval.
q. End of demand interval.
r. Over/under analog inputs.
s. Current sag/swell.
t. Voltage sag/swell.

3. For each over/under metered alarm value, provide for the user to define a pickup, dropout, and delay.
4. The circuit meter and monitor alarms response time must be not less than one second.
5. Provide for up to four alarms to be combined to give a single result using Boolean algebra operations.

P. EN 50160 Evaluation: Report EN 50160 evaluation data in the following formats: summary of active evaluations, summary of evaluation status, detailed information for each evaluated parameter, and detailed information for each abnormal event.

Q. I/O Module: Modular, with multiple I/O options to accomplish specified performance and one or more spare positions for future.

1. KY Pulse: Generate a standard KY pulses for a user-defined increment of metered active energy as follows:

a. User-defined pulse output, associated with kWh.
b. Alarm pulse output, which turns on the pulsing at user-defined point.

2. Digital Inputs: As follows:

a. One input connection rated 24 to 125 V(ac) or V(dc), +/- 10 percent, less than 5 mA burden, 1350 V RMS isolation.
b. Six input connections rated 19 to 30 V(dc), 5 mA maximum at 24 V(dc). Provide an onboard 24 V(dc) power supply.
c. Two input connections rated 20 to 150 V(dc) or V(ac), 2 mA maximum.

3. Analog inputs, no fewer than two, adjustable from zero to 5 V(dc) or 4 to 20 mA.
4. Outputs to operate field-installed relays, no fewer than two, providing 6 to 240 V(ac) or 6 to 30 V(dc), 2 A RMS. 5 A maximum for 10 seconds per hour.
5. Analog outputs, no fewer than two, 4 to 20 mA(dc) into 600 ohms maximum.

R. Data Recording: Store the listed values in instrument's nonvolatile memory, indicate which of the three phases relates to the value. Attach a date and time stamp to the peak values and the alarms.

1. Data Logs, General: User configurable. Automatically stamp each entry to the millisecond with date and time.

a. Each log entry must hold data of up to 96 parameters each.
b. Each log must be user configurable to log data at a different user-defined schedule interval.
c. Provide each log with user-defined event or a minimum/maximum condition that will trigger log file entries.
d. Configure log entries to be recorded as Fill & Hold or Circular (First in, First out, or FIFO), as defined by the user.

2. Minimum/Maximum Logs:

a. Minimum/Maximum/Average interval log also logs minimum/maximum/average of selected parameters on a selected interval from a user-selected interval length from 1 to 1440 seconds.
b. Minimum/Maximum log must include the time, date, and value for the minimum and maximum of each of the real-time metered values.

3. Alarm Log: Record time, date, event information, and coincident information for each user-defined and automatically initiated alarm or event. Record selected parameters at 100 ms intervals during events and alarms. Automatically stamp each entry to the millisecond with date and time.
4. Waveform Logs: Capture and store waveforms, from 185 cycles on one channel at 16 samples per cycle, up to 3 cycles on six channels at 128 samples per cycle as defined by the user. Waveform log entries must be externally triggered or forced in response to a user-defined event. Configure log entries to be recorded as Fill & Hold or Circular (FIFO), as defined by the user.

S. Capacities and Characteristics:

1. Power Supply: **120 V(ac), 60 Hz**.
2. Circuit Connections:

a. Voltage: Measurement autoranging, zero to 600 V(ac) L-L, zero to 347 V(ac) L-N. **Connect directly to low-voltage (600 V and less) without using voltage transformers.** Meter impedance must be 2 megohm L-L or greater. Overload Tolerance: 1500 V(ac), RMS, continuously.
b. Current: Connect to instrument grade current transformer with a metering range of 5 mA to 6 A. Overcurrent tolerance of the instrument must be 10 A continuous, 50 A for 10 seconds once per hour, and 120 A for one second per hour.
c. Frequency: 45 to 65 Hz.
d. Time: Input from a GPS receiver to synchronize the internal clock of the instrument and to time-synchronize this instrument with the network to a deviation of not greater than 1 ms.

If specifying more than one type of circuit meter and explorer, copy "Circuit Meter and Explorer" Article below, insert drawing designation, and edit for each type of circuit meter and explorer required. See "Specifying Multiple Instrument Types" Article in the Evaluations.

2.6 PC OPERATING SYSTEM SOFTWARE

A. Description: System software must monitor, analyze, display, control, and save the parameters and features available at the connected meter.

B. Software: Configured to run on a portable laptop computer, a single PC, or a tablet computer, with capability for accessing a single meter at a time, at the location of the meter. System is not connected to LAN.

C. Minimum Requirements:

1. Real-time multitasking and multiuser **64-**]bit operating system that allows execution of multiple real-time programs and custom program development.
2. Operating system must be capable of operating Microsoft Windows applications.
3. Scheduling software must schedule centrally based time and event, temporary, and exception day programs.

2.7 NETWORKED PC OPERATING SYSTEM SOFTWARE

A. Description: System software must monitor, analyze, display, control, and save parameters and features available at each of the connected meters.

B. Software: Configured to run on a single PC, with capability for accessing multiple devices simultaneously. Software must include interactive graphics client and must be web enabled.

C. System Software Minimum Requirements:

1. Real-time multitasking and multiuser **64-**bit operating system that allows concurrent multiple workstations operating and concurrent execution of multiple real-time programs and custom program development.
2. Operating system must be capable of operating Microsoft Windows applications.
3. Database management software must manage data on an integrated and non-redundant basis. Additions and deletions to database must be without detriment to existing data. Include cross linkages so no data required by a program can be deleted by an operator until that data have been deleted from respective programs.
4. Scheduling software must schedule centrally based time and event, temporary, and exception day programs.

D. Operator Interface Software:

1. Minimize operator training through use of English language prorating and English language point identification.
2. Minimize use of a typewriter-style keyboard through use of a pointing device, touchscreen, or mouse.
3. Operator sign-off must be a manual operation or, if no keyboard or mouse activity takes place, an automatic sign-off.
4. Automatic sign-off period must be programmable from 1 to 60 minutes in 1-minute increments on a per operator basis.
5. Record operator sign-on and sign-off activity.
6. Security Access:

a. Operator access to electrical monitoring and control system must be under password control.
b. An alphanumeric password must be user assignable to each operator.
c. Software must have at least five access levels.

1) View - View information. No change privileges allowed.
2) User - Same as View, but is able to initiate control functions.
3) Controller - Same as User, but is able to initiate communications.

4) Operator - Same as Controller, but is able to modify configurations.
5) Supervisor - Same as Operator, but is able to administer security privileges.

d. Each menu item must be assigned an access level so that a one-for-one correspondence between operator-assigned access level(s) and menu-item access level(s) is required to gain access to menu item.
e. Display menu items to operator with those menu items capable of access highlighted. Menu and operator access level assignments must be online programmable and under password control.

E. Graphic Interface Software:

1. Include a full interactive graphical selection means of accessing and displaying system data to operator.
2. Descriptors for graphics, points, alarms, and such must be modified through workstation under password control.
3. Display operator accessed data on the monitor.
4. Help Features: On-line context-sensitive help utility to facilitate operator training and understanding.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF POWER MONITORING AND CONTROL SYSTEMS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. Wiring and Cabling Installation:

1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.
2. Comply with Section 260523 "Control-Voltage Electrical Power Cables" for control wiring.

D. Raceways Installation:

1. Comply with Section 260533.13 "Conduits for Electrical Systems" for electrical power wiring and NFPA 70 Class 1 remote-control and signaling circuits.
2. Comply with Section 270528 "Pathways for Communications Systems" for control wiring, TIA-232 cable, and NFPA 70 Class 2 remote-control and signaling circuits.

E. Identification Installation:

1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.
2. Comply with Section 271513 "Communications Copper Horizontal Cabling" for identification products and cable management system requirements for twisted pair cable, TIA-485 cable, control-voltage cable, and TIA-232 cable.
3. Comply with Section 271523 "Communications Optical Fiber Horizontal Cabling" for identification products and cable management system requirements for optical-fiber cable.

3.3 INSTALLATION OF WORKSTATIONS

A. Desktop Workstations Installation:

1. Install workstation(s) at location(s) directed by Owner.
2. Install multiple-receptacle power strip with cord for use in connecting multiple workstation components to a single, duplex electrical power receptacle.
3. Install software on workstation(s) and verify that software functions properly.
4. Develop Project-specific graphics, trends, reports, logs, and historical database.
5. Power workstation through a UPS unit. Locate UPS adjacent to workstation.

B. Portable Workstations Installation:

1. Turn over portable workstations to Owner at Substantial Completion.
2. Install software on workstation(s) and verify that software functions properly.

C. Graphics Application:

1. Use system schematics indicated as starting point to create graphics.
2. Develop Project-specific library of symbols for representing system equipment and products.
3. Incorporate digital images of Project-completed installation into graphics where beneficial to enhance effect.
4. Submit sketch of graphic layout with description of text for each graphic for Owner's **and Architect's** review before creating graphic using graphics software.
5. Seek Owner input in graphics development once using graphics software.
6. Final editing must be done on-site with Owner's review and feedback.
7. Refine graphics as necessary for Owner acceptance.
8. On receiving Owner acceptance, print a hard copy to include in operation and maintenance manual. Prepare a scanned copy PDF file of each graphic and include with softcopy of the system operation and maintenance manual.

3.4 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

3.5 GROUNDING

A. For data communication wiring, comply with BICSI N1.

B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Visually inspect balanced twisted pair cabling and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of components.
4. Test balanced twisted pair cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.

    a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

5. Optical-Fiber Cable Tests:

    a. Test instruments must meet or exceed applicable requirements in TIA-568-C.0. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Link End-to-End Attenuation Tests:

        1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to IEC 61280-4-1.
        2) Attenuation test results for links must be less than [**2.0 dB**] [**that calculated according to equation in TIA-568-C.0**].

    c. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

6. Power Monitoring and Control System Tests.

    a. Test Analog Signals:

        1) Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.

2) Check analog current signals using a precision current meter at zero, 50, and 100 percent.
3) Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

b. Test Digital Signals:

1) Check digital signals using a jumper wire.
2) Check digital signals using an ohmmeter to test for contact making or breaking.

c. I/O Control Loop Tests:

1) Test every I/O point to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
2) Test every I/O point throughout its full operating range.
3) Test every control loop to verify that operation is stable and accurate.
4) Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
5) Test and adjust every control loop for proper operation according to sequence of operation.
6) Test software and hardware interlocks for proper operation.
7) Operate each analog point at the following:

a) Upper quarter of range.
b) Lower quarter of range.
c) At midpoint of range.

8) Exercise each binary point.
9) For every I/O point in the system, read and record each value at workstation, at controller, and at field instrument simultaneously. Value displayed at workstation and at field instrument must match.
10) Prepare and submit a report documenting results for each I/O point in the system, and include in each I/O point a description of corrective measures and adjustments made to achieve desire results.

C. Nonconforming Work:

1. Wiring and cabling will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 FINAL REVIEW

A. Submit written request to Architect [**and**] [**Construction Manager**] when the power monitoring and control system is ready for final review. Written request must state the following:

1. The system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.

2. The system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
3. The system monitoring and control of electrical distribution systems results in operation according to sequences of operation indicated.
4. The system is complete and ready for final review.

B. Review by [**Architect**] [**and**] [**Construction Manager**] will be made after receipt of written request. A field report must be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Final review must include a demonstration to parties participating in final review.

3.8 MAINTENANCE SERVICE

A. Beginning at Substantial Completion, maintenance service must include [**three**] [**six**] [**nine**] [**12**] months' full maintenance by manufacturer's authorized service representative. Include [**quarterly**] [**semiannual**] [**annual**] preventive maintenance, repair or replacement of defective components, cleaning, and adjusting as required for proper system operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

3.9 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement must include software support for **two** years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least **30** days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.10 TRAINING

A. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of training materials and visual presentations.
2. Hard-copy materials must be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of hard-copy materials.

B. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power, and data connectivity for instructor and each attendee.
2. Instructor must provide training materials, projector, and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training must include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration, and service requirements.
5. The workstation provided with the system must be used in training. If workstation is not indicated, provide a temporary workstation to convey training content.

C. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables, chairs, power, and data connectivity for each attendee.
2. Provide capability to remotely access to Project monitoring and control system for use in training.
3. Provide a workstation for use by each attendee.

D. At Completion of Training: Staff familiar with the system installed are capable of demonstrating operation of the system during final review.

E. Demonstration must include, but not be limited to, the following:

1. Accuracy and calibration of **10** I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
2. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and workstations.
3. Trends, summaries, logs, and reports set-up for Project.
4. Software's ability to communicate with controllers, workstations, and uploading and downloading of control programs.
5. Software's ability to edit control programs off-line.
6. Data entry to show Project-specific customizing capability including parameter changes.
7. Step through penetration tree, display graphics, demonstrate dynamic update, and direct access to graphics.
8. Execution of digital and analog commands in graphic mode.
9. Spreadsheet and curve plot software and its integration with database.
10. Online user guide and help functions.
11. For Each Meter:

    a. Memory: Programmed data, parameters, trend, and alarm history collected during normal operation is not lost during power failure.
    b. Operator Interface: Ability to connect directly to each meter with a portable workstation.
    c. Wiring Labels: Match control drawings.
    d. Network Communication: Ability to locate a meter on the network. Communication architecture matches Shop Drawings.
    e. Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators, and devices.

12. For Each Workstation:

    a. I/O point lists agree with naming conventions.
    b. Graphics are complete.

c. UPS unit, if applicable, operates.

END OF SECTION 260913

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electronic dial-time switches.
2. Outdoor photoelectric switches, solid state, flexible mounting.
3. Outdoor photoelectric switches, low voltage.
4. Daylight-harvesting switching controls.
5. Daylight-harvesting dimming controls, analog.
6. Daylight-harvesting dimming controls, digital.
7. Indoor occupancy and vacancy sensors.
8. Switchbox-mounted occupancy sensors.
9. Digital timer light switch.
10. High-bay occupancy sensors.
11. Extreme-temperature occupancy sensors.
12. Outdoor motion sensors.
13. Lighting contactors.
14. Emergency shunt relay.
15. Conductors and cables.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Electronic dial-time switches.
2. Electromechanical dial-time switches.
3. Outdoor photoelectric switches, solid state, flexible mounting.
4. Outdoor photoelectric switches, solid state, luminaire-mounted.
5. Outdoor photoelectric switches, low voltage.
6. Daylight-harvesting switching controls.
7. Daylight-harvesting dimming controls, analog.
8. Daylight-harvesting dimming controls, digital.
9. Indoor occupancy and vacancy sensors.
10. Switchbox-mounted occupancy sensors.
11. Digital timer light switch.

12. High-bay occupancy sensors.
13. Extreme-temperature occupancy sensors.
14. Outdoor motion sensors.
15. Lighting contactors.
16. Emergency shunt relay.
17. Conductors and cables.

B. Shop Drawings:

1. Show installation details for the following:

a. Occupancy sensors.
b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

C. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranties.

1.4 WARRANTY

A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of lighting control software.
b. Faulty operation of lighting control devices.

2. Extended Warranty Period: **Two** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTRONIC TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. Schneider Electric USA, Inc.
6. TE Connectivity Ltd.
7. Touché Lighting Control.

8. nLight; Acuity Brands Lighting, Inc.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Contact Configuration: **SPST**.
3. Contact Rating: **30 A inductive or resistive, 240 V(ac)**.
4. Programs:

   a. Eight on-off set points on a 24-hour schedule **and an annual holiday schedule that overrides the weekly operation on holidays**.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program **on selected channels**.
6. Astronomic Time: **All** channels.
7. Automatic daylight savings time changeover.
8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, FLEXIBLE MOUNTING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. TE Connectivity Ltd.
6. nLight; Acuity Brands Lighting, Inc.

B. Description: Solid state, with **SPST** dry contacts rated for **1000 W incandescent or 1800 VA inductive**, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range**, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off**.
3. Time Delay: Fifteen-second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure **from same source and manufacturer as switch**.
6. Failure Mode: Luminaire stays ON.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES, LOW VOLTAGE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. TE Connectivity Ltd.
6. nLight; Acuity Brands Lighting, Inc.

B. Description: Solid state; one set of NO dry contacts rated for **24 V(dc) at 1 A**, to operate connected load, complying with UL 773, and compatible with **luminaire**, **power pack** or **lighting control panelboard**.

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Mounting: 1/2 inch (13 mm) threaded male conduit.
5. Failure Mode: Luminaire stays ON.
6. Power Pack:

    a. Dry contacts rated for **20 A LED** load at 120 and 277 V(ac), for **13** A tungsten at 120 V(ac), and for **1 hp** at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.

        1) LED status lights to indicate load status.
        2) Plenum rated.

    b. Digital controller capable of accepting **three**] [**four** 8PSJ inputs with **one** outputs rated for **20 A LED** load at 120 and 277 V(ac), for **16 A LED**] at 120 and 277 V(ac), and for **1 hp** at 120 V(ac). Sensor has 24 V(dc), Class 2 power source.

        1) With integral current monitoring.
        2) Compatible with digital addressable lighting interface.
        3) Plenum rated.

2.4 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Hubbell Control Solutions; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
3. Leviton Manufacturing Co., Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. NSi Industries LLC.
6. Sensor Switch, Inc.
7. TE Connectivity Ltd.
8. WattStopper; Legrand North America, LLC.

9. nLight; Acuity Brands Lighting, Inc.

B. Description: System operates indoor lighting.

C. Sequence of Operation: As daylight increases, the lights are turned off at a predetermined level. As daylight decreases, the lights are turned on at a predetermined level.

1. Lighting control set point is based on two lighting conditions:

a. When no daylight is present.
b. When significant daylight is present (target level).
c. System programming is done with two hand-held, remote-control tools.

D. Ceiling-Mounted Switching Controls:

1. Solid-state, light-level sensor unit, with **integrated** power pack, that detects changes in indoor lighting levels that are perceived by the eye.
2. Solid-state, light-level sensor unit, with separate power pack **mounted on luminaire**, that detects changes in indoor lighting levels that are perceived by the eye.

E. Electrical Components, Devices, and Accessories:

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Sensor Output:
   a. Digital signal compatible with power pack.
4. Sensor type: **Open loop**.
5. Zone: **Multi**.
6. Power Pack:

   a. Digital controller capable of accepting **4** 8PSJ inputs with **two** outputs rated for **20 A**]**LED** load at 120 and 277 V(ac), for **16 A ballast or LED** at 120 and 277 V(ac), and for **1 hp** at 120 V(ac). Sensor has 24 V(dc) Class 2 power source. With integral current monitoring
      1) Compatible with digital addressable lighting interface.
      2) Plenum rated.

7. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lx), with an adjustment for turn-on and turn-off levels within that range.
8. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lx), with an adjustment for turn-on and turn-off levels within that range.
9. Skylight Sensors Light-Level Monitoring Range: 1000 to 10 000 fc (10 800 to 108 000 lx), with an adjustment for turn-on and turn-off levels within that range.
10. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
11. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
12. Test Mode: User selectable, overriding programmed time delay to allow settings check.
13. Control Load Status: User selectable to confirm that load wiring is correct.
14. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.5 DAYLIGHT-HARVESTING DIMMING CONTROLS, DIGITAL

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Deep Roof Lighting.
2. Eaton.
3. Hubbell Control Solutions; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. WattStopper; Legrand North America, LLC.
7. nLight; Acuity Brands Lighting, Inc.

B. Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, lights are dimmed.

1. Lighting control set point is based on the following two lighting conditions:

   a. When no daylight is present (target level).
   b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

   a. Initial setup tool.
   b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with **integrated** or **separate** power pack **mounted on luminaire**, to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Sensor Output: zero to 10 V(dc) to operate luminaires. Sensor is powered by controller unit.
3. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lx).

E. Power Pack: Digital controller capable of accepting **three** 8PSJ inputs with [**one**] [**two**] output(s) rated for **20 A LED**] load at 120 and 277 V(ac), for **16 A LED** at 120 and 277 V(ac), and for [**1 hp**] <**Insert value**> at 120 V(ac). Sensor has 24 V(dc) Class 2 power source.

1. With integral current monitoring.
2. Compatible with digital addressable lighting interface.
3. Plenum rated.

2.6 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. nLight; Acuity Brands Lighting, Inc.

B. General Requirements for Sensors:

1. **Ceiling**-mounted, solid-state indoor **occupancy and vacancy** sensors.
2. **Dual** technology.
3. **Integrated** or **Separate** power pack.
4. **Hardwired** or **Wireless** connection to switch **and BAS and lighting control system**.
5. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
6. Operation:
   a. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: **Wireless**.
8. Power: **Line voltage** or **Integral photovoltaic collector**.
9. Power Pack: Dry contacts rated for 20 A **LED** load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
10. Mounting:

    a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
    b. Relay: Externally mounted through a 1/2 inch (13 mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); turn lights off when selected lighting level is present.

PIR Type: **Wall** or **Ceiling** mounted; detect occupants in coverage area by their heat and movement.

14. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm).
15. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.

C. Ultrasonic Type: **Wall** or **Ceiling** mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.

5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 ft. (27.4 m) when mounted on a 10 ft. (3 m) high ceiling in a corridor not wider than 14 ft. (4.3 m).
6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of [**1000 sq. ft. (110 sq. m)**] [**2000 sq. ft. (220 sq. m)**] [**3000 sq. ft. (330 sq. m)**] when mounted 84 inch (2100 mm) above finished floor.

D. Dual-Technology Type: **Wall** or **Ceiling** mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm), and detect a person of average size and weight moving not less than 12 inch (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inch/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96 inch (2440 mm) high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of [**1000 sq. ft. (110 sq. m)**] [**2000 sq. ft. (220 sq. m)**] [**3000 sq. ft. (330 sq. m)**] when mounted 48 inch (1200 mm) above finished floor.

2.7 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bryant; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Douglas Lighting Controls.
3. Eaton.
4. Hubbell Control Solutions; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
5. Intermatic, Inc.
6. Leviton Manufacturing Co., Inc.
7. Lithonia Lighting; Acuity Brands Lighting, Inc.
8. Lutron Electronics Co., Inc.
9. NSi Industries LLC.
10. Philips; Signify North America; Signify Holding.
11. RAB Lighting.
12. Sensor Switch, Inc.
13. Square D; Schneider Electric USA.
14. WattStopper; Legrand North America, LLC.
15. nLight; Acuity Brands Lighting, Inc.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox**, with provisions for connection to BAS using hardwired connection** or **using wireless connection**].

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
4. Switch Rating: Not less than 800 VA **LED** load at 120 V, 1200 VA **LED** load at 277 V, and 800 W incandescent.

C. Wall-Switch Sensor Tag WS1:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of [**900 sq. ft. (84 sq. m)**] [**2100 sq. ft. (196 sq. m)**].
2. Sensing Technology: [**PIR**] [**Dual technology - PIR and ultrasonic**].
3. Switch Type: [**SP.**] [**SP, dual circuit.**] [**SP, manual "on," automatic "off."**] [**SP, field-selectable automatic "on," or manual "on," automatic "off."**]
4. Capable of controlling load in three-way application.
5. Voltage: [**Match the circuit voltage**] [**120 V**] [**277 V**] [**Dual voltage - 120 and 277 V**].
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
9. Color: [**White**] [**Black**] <**Insert color**>.
10. Faceplate: Color matched to switch.

D. Wall-Switch Sensor Tag WS2:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.
3. Switch Type: [**SP.**] [**SP, dual circuit.**] [**SP, manual "on," automatic "off."**] [**SP, field-selectable automatic "on," or manual "on," automatic "off."**]
4. Capable of controlling load in three-way application.
5. Voltage: [**Match the circuit voltage**] [**120 V**] [**277 V**] [**Dual voltage, 120 and 277 V**].
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Color: [**White**] [**Black**] <**Insert color**>.
11. Faceplate: Color matched to switch.

2.8 DIGITAL TIMER LIGHT SWITCH

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Intermatic, Inc.
3. Leviton Manufacturing Co., Inc.
4. NSi Industries LLC.
5. Schneider Electric USA, Inc.
6. TE Connectivity Ltd.
7. nLight; Acuity Brands Lighting, Inc.

B. Description: Combination digital timer and conventional switch lighting control unit. Switchbox-mounted, backlit LCD display, with selectable time interval in [**10**] [**20**] minute increments.

1. Rated 960 W at 120 V(ac) for tungsten lighting, 10 A at 120 V(ac) or 10 A at 277 V(ac) for fluorescent or LED lighting, and 1/4 hp at 120 V(ac).
2. Standards: Comply with UL 20.
3. Integral relay for connection to BAS.
4. Voltage: **Match the circuit voltage**.
5. Color: [**White**] [**Black**] <**Insert color**>.
6. Faceplate: Color matched to switch.

2.9 OUTDOOR MOTION SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bryant; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Eaton.
3. Hubbell Control Solutions; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
4. Leviton Manufacturing Co., Inc.
5. Lithonia Lighting; Acuity Brands Lighting, Inc.
6. NSi Industries LLC.
7. RAB Lighting.
8. Sensor Switch, Inc.
9. WattStopper; Legrand North America, LLC.
10. nLight; Acuity Brands Lighting, Inc.

B. Description: Solid-state outdoor motion sensors.

1. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. **Dual-technology (PIR and ultrasonic)** type, weatherproof. Detect occurrences of 6 inch (150 mm) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch (23 200 sq. mm). Comply with UL 773A.
3. Switch Rating:
   a. Luminaire-Mounted Sensor: **500 VA LED**.
   b. Separately Mounted Sensor: Dry contacts rated for 20 A **LED** load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
4. Switch Type: **SP.**
5. Voltage: **Match the circuit voltage**type.
6. Detector Coverage:
   a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
   b. Long Range: 180-degree field of view and 110 ft. (34 m) detection range.
7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lx). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Concealed, "off" time-delay selector at 30 seconds and 5, 10, and 20 minutes.
10. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and help eliminate false "off" switching.
11. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" in accordance with UL 773A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SENSORS

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

3.3 INSTALLATION OF CONTACTORS

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.4 INSTALLATION OF WIRING

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.

C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.6 FIELD QUALITY CONTROL

A. Field tests must be witnessed by **authorities having jurisdiction.**

B. Tests and Inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Nonconforming Work:

1. Lighting control devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Prepare test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 MAINTENANCE

A. Software and Firmware Service Agreement:

1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software support for **two** years.
2. Upgrade Service: At Substantial Completion, update software and firmware to latest version. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Verify upgrading software includes operating system and new or revised licenses for using software.

    a. Upgrade Notice: No fewer than **30** days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

END OF SECTION 260923

SECTION 262213

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation[**and testing**] instructions issued to Installer by manufacturer for the following:

1. Transformer temporary heating, working clearances, anchoring, torque values, and insulation-resistance testing.

B. Source quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Acme Electric; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
3. Eaton.
4. Hammond Power Solutions Inc.
5. Jefferson Electric, Inc.
6. Lincoln Electric Products Co., Inc.
7. MGM Transformer Company.
8. Mirus International Inc.
9. Powersmiths International Corp.; Socomec Group.
10. Siemens Industry, Inc., Energy Management Division.
11. SolaHD; Emerson Electric Co., Automation Solutions.
12. Square D; Schneider Electric USA.

B. Source Limitations: Obtain each type of transformer from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70**, and list and label as complying with UL 1561**.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume must allow efficient transformer operation at 10 percent above nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings **without splices** except for taps.

1. Coil Material: **Aluminum Copper**.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: **Welded**.

D. Encapsulation: Transformers smaller than 30 kVA must have core and coils completely resin encapsulated.

E. Enclosure: **Ventilated**.

1. Core and coil must be encapsulated within resin compound **using vacuum-pressure impregnation process** to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Environmental Protection:

   a. Indoor: UL 50E, **Type 2**.
   b. Outdoor: UL 50E, **Type 3R**.

5. Finish Color: [**Gray**] [**ANSI 49 gray**] [**ANSI 61 gray**] weather-resistant enamel.

F. Taps for Transformers 3 kVA and Smaller: **None**.

G. Taps for Transformers 7.5 to 24 kVA: **One 5 percent tap above and one 5 percent tap below normal full capacity**.

H. Taps for Transformers 25 kVA and Larger: **Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity**.

I. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.

J. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of **115 deg C** rise above 40 deg C ambient temperature.

K. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.

L. K-Factor Rating: Transformers indicated to be K-factor rated must comply with UL 1561 requirements for nonsinusoidal load current-handling capability to degree defined by designated K-factor.

1. Unit may not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding indicated insulation class in 40 deg C maximum ambient and 24-hour average ambient of 30 deg C.
2. Indicate value of K-factor on transformer nameplate.
3. Unit must comply with requirements of DOE 2016 efficiency levels when tested in accordance with NEMA TP 2 with K-factor equal to one.

M. Electrostatic Shielding: Windings must have independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding shield.

N. Wall Brackets: **Manufacturer's standard brackets**.

O. Low-Sound-Level Requirements: Maximum sound levels when factory tested in accordance with IEEE C57.12.91.

2.4 IDENTIFICATION

A. Nameplates:

1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."
2. Self-adhesive label for distribution transformers. Self-adhesive labels are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Testing Administrant: **Owner will engage Engage** qualified electrical testing agency to evaluate transformer.

B. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of [**manufacturer's**] [**qualified electrical testing laboratory's**] certification of system compliance on control units.

1. Resistance measurements of windings at rated voltage connections and at tap connections.
2. Ratio tests at rated voltage connections and at tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:
    a. Line-side to ground.
    b. Load-side to ground.
    c. Line-side to load-side.
9. Temperature tests.
10. Factory Sound-Level Tests: **Conduct prototype sound-level tests on production-line products**.

C. Nonconforming Work:

1. System equipment that does not pass tests and inspections will be considered defective.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.

E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated **by transformer manufacturer**.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions**, seismic requirements applicable to Project,** and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base in accordance with manufacturer's published instructions.

E. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

A. [

B. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

C. Tests and Inspections:

1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:

a. Visual and Mechanical Inspection.

1) Inspect physical and mechanical condition.
2) Inspect anchorage, alignment, and grounding.
3) Verify that resilient mounts are free and that shipping brackets have been removed.
4) Verify that unit is clean.
5) Perform specific inspections and mechanical tests recommended by manufacturer.
6) Verify that as-left tap connections are as specified.
7) Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

1) Measure resistance at windings, taps, and bolted connections.
2) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
3) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

2. Large (Larger Than 167 kVA Single Phase or 500 kVA Three Phase) Dry-Type Transformer Field Tests:

a. Visual and Mechanical Inspection:

1) Inspect physical and mechanical condition.
2) Inspect anchorage, alignment, and grounding.
3) Verify that resilient mounts are free and that shipping brackets have been removed.
4) Verify that unit is clean.
5) Perform specific inspections and mechanical tests recommended by manufacturer.
6) Verify that as-left tap connections are as specified.
7) Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

1) Measure resistance at windings, taps, and bolted connections.
2) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
3) Perform power-factor or dissipation-factor tests on windings.
4) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
5) Perform excitation-current test on each phase.
6) Perform applied voltage test on line- and load-side windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
7) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

D. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.

E. Nonconforming Work:

1. Transformer will be considered defective if it does not pass tests and inspections.
2. Remove and replace units that do not pass tests or inspections and retest as specified above.

F. Assemble and submit test and inspection reports.

G. Manufacturer Services:

1. Engage factory-authorized service representative to [**support**] [**supervise**] field tests and inspections.

3.5 ADJUSTING

A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.7 MAINTENANCE

A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.

1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform two follow-up infrared scans of transformers, one at four months and another at 11 months after Substantial Completion.
3. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 262213

SECTION 262413

SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Switchboards.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.

B. Related Requirements

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.2 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Switchboards.
2. Overcurrent protective devices.
3. Surge protection devices.
4. Ground-fault protection devices.
5. Accessories.
6. Other components.
7. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than UL 50E, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
10. Include diagram and details of proposed mimic bus.
11. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Samples: Representative portion of mimic bus with specified material and finish, for color selection.

D. Field Quality-Control Submittals:

1. Field Quality-Control Reports:

a. Test procedures used.
b. Test results that comply with requirements.
c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation[**and testing**] instructions issued to Installer by manufacturer for the following:

1. Handling, storing, and providing temporary heat.
2. Mounting accessories and anchoring devices.
3. Testing and adjusting overcurrent protective devices.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. **Include the following:**

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents.**Include the following:**

1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
2. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
3. Portable Circuit-Breaker Lifting Device: Floor-supported, roller-based, elevating carriage arranged for movement of circuit breakers in and out of compartments for present and future circuit breakers.
4. Overhead Circuit-Breaker Lifting Device: Mounted at top front of switchboard, with hoist and lifting yokes matching each drawout circuit breaker.
5. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. ve loose packing and flammable materials from inside switchboards and [**install temporary electric heating (250 W per section)**] [**connect factory-installed space heaters to temporary electrical service**] to prevent condensation.

C. Handle and prepare switchboards for installation in accordance with **NECA 400**, **NEMA PB 2.1**.

1.8 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed switchboard perform in accordance with specified requirements and agrees to repair or replace components that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: **Two** years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

on Drawings. Note that ICCB, LVPCB, and bolted pressure contact switches are individually mounted.

H. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: **Panel** or **Fixed, individually** mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

I. Nominal System Voltage: **480Y/277 V**.

J. Main-Bus Continuous: per drawings. [**5000**] [**4000**] [**3000**] [**2500**] [**2000**] [**1600**] [**1200**] A.

K. Indoor Enclosures: Steel, UL 50E, **Type 1**.

L. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's **standard gray** finish over rust-inhibiting primer on treated metal surface.

M. Barriers: Between adjacent switchboard sections.

N. Insulation and isolation for **main bus of main section and** main and vertical buses of feeder sections.

O. Service Entrance Rating where shown on drawings: Switchboards intended for use as service entrance equipment may contain from one to six service disconnecting means with overcurrent protection, neutral bus with disconnecting link, grounding electrode conductor terminal, and main bonding jumper.

P. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

Q. Customer Metering Compartment: Separate customer metering compartment **and section with front hinged door,** and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring must be terminated on shorting-type terminal blocks. **Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.**

R. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

S. Removable, Hinged Rear Doors and Compartment Covers: Secured by **captive thumb screws**, for access to rear interior of switchboard.

T. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

U. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from front of switchboard.
2. Phase- and Neutral-Bus Material:
    a. Hard-drawn copper of 98 percent conductivity**, silver-plated**.
    b. Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
3. Copper feeder circuit-breaker line connections.
4. Tin-plated aluminum feeder circuit-breaker line connections.
5. Ground Bus: **1/4 by 2 inch (6 by 50 mm-)** hard-drawn copper of 98 percent conductivity, equipped with **mechanical** connectors for feeder and branch-circuit ground conductors.
6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
7. Disconnect Links:
    a. Isolate neutral bus from incoming neutral conductors.
    b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
8. Neutral Buses: **100** percent of ampacity of phase buses unless otherwise indicated, equipped with **mechanical** connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
9. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

V. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

W. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.2 SURGE PROTECTION DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Advanced Protection Technologies Inc. (APT).
3. Eaton.
4. Siemens Industry, Inc., Energy Management Division.
5. Square D; Schneider Electric USA.

B. SPDs: Listed and labeled in accordance with UL 1449.

C. Features and Accessories:

1. Integral disconnect switch.
2. Internal thermal protection that disconnects SPD before damaging internal suppressor components.
3. Indicator light display for protection status.
4. Form-C contacts rated at **5 A and 250 V(ac)**, one normally open and one normally closed, for remote monitoring of protection status. **Contacts must reverse on failure of surge diversion module or on opening of current-limiting device. Coordinate with building power monitoring and control system.**
5. Surge counter.

D. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase may not be less than [**200 kA**] [**250 kA**] [**300 kA**] <**Insert amperes**>. Peak surge current rating must be arithmetic sum of ratings of individual MOVs in each mode.

Retain one of first two paragraphs below. Verify compatibility of peak surge current rating and voltage protection rating (VPR).

E. Protection modes and UL 1449 VPR for grounded wye circuits with [**480Y/277 V**] [**208Y/120 V**], three-phase, four-wire circuits may not exceed the following:

1. Line to Neutral: [**1200 V for 480Y/277 V**] [**700 V for 208Y/120 V**].
2. Line to Ground: [**1200 V for 480Y/277 V**] [**1200 V for 208Y/120 V**].
3. Line to Line: [**2000 V for 480Y/277 V**] [**1000 V for 208Y/120 V**].

F. SCCR: Equal or exceed [**100 kA**] [**200 kA**].

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long and short time adjustments.
    d. Ground-fault pickup level, time delay, and I squared t response where required

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

Retain "GFCI Circuit Breakers" Subparagraph below for GFCI circuit breakers for personnel ground-fault protection as required by NFPA 70; retain "Ground-Fault Equipment Protection (GFEP) Circuit Breakers" Subparagraph for GFEP circuit breakers (e.g., for self-limiting heat-trace cables) as required by NFPA 70. GFCI and GFEP circuit breakers are only available fully rated up to interrupting ratings of 22 kA and are not suited to switchboard use. For switchboards subject to fault currents above 22 kA, series ratings must be used. Consider relocating these to downstream panelboards more suited to their application.

6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30 mA trip).
8. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: **Mechanical** style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: **Integrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Communication Capability: **Circuit-breaker-mounted** or **Universal-mounted Integral** or **Din-rail-mounted** communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
    g. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    i. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
    j. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key must be removable only when circuit breaker is in off position. (Where required and shown on drawings)

B. Insulated-Case Circuit Breaker (ICCB): **80** percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

    1. **Fixed** or **Drawout** circuit-breaker mounting as shown on drawings.

2. Two-step, stored-energy closing.
3. **Full**-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Time adjustments for long- and short-time pickup.
    c. Ground-fault pickup level, time delay, and I squared t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Remote trip indication and control.
6. Communication Capability: Web enabled integral Ethernet communication module and embedded Web server with factory-configured Web pages (HTML file format). Provide functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key must be removable only when circuit breaker is in off position.

Retain voltage in "Control Voltage" Subparagraph below to match control power supply.

8. Control Voltage: [**40 V(dc)**] [**125 V(dc)**] [**250 V(dc)**] [**120 V(ac)**].

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

D. Fuses are specified in Section 262813 "Fuses."

2.4 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

    a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
    d. Megawatts: Plus or minus 1 percent.
    e. Megavars: Plus or minus 1 percent.
    f. Power Factor: Plus or minus 1 percent.
    g. Frequency: Plus or minus 0.1 percent.
    h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
    i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
    j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

B. Voltmeters: Cover expanded-scale range of nominal voltage plus 10 percent.

2.5 CONTROL POWER

A. Control Circuits:

1. 120 V(ac), supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards in accordance with **NEMA PB 2.1**.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's published instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage in accordance with manufacturer's published instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect performance of equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

3.3 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Switchboards and Accessories: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with **NEMA PB 2.1**.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Equipment Mounting: Install switchboards on concrete base, 4 inch (100 mm) nominal thickness. Comply with requirements for concrete base specified in Section 260529 "Hangers and Supports for Electrical Systems."

    a. Install conduits entering underneath switchboard, entering under vertical section where conductors will terminate. Install with couplings flush with concrete base. Extend 2 inch (50 mm) above concrete base after switchboard is anchored in place.
    b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch (450 mm) centers around full perimeter of concrete base.
    c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
    d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, published instructions, and directions furnished with items to be embedded.
    e. Install anchor bolts to elevations required for proper attachment to switchboards.
    f. Anchor switchboard to building structure at top of switchboard if required or recommended by manufacturer.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
3. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
4. Operating Instructions: Frame and mount printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
5. Install filler plates in unused spaces of panel-mounted sections.
6. Install overcurrent protective devices, surge protection devices, and instrumentation.

    a. Set field-adjustable switches and circuit-breaker trip ranges.

7. Install spare-fuse cabinet.

3.4 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

B. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

C. Bond conduits entering underneath switchboard to equipment ground bus with bonding conductor sized in accordance with NFPA 70.

D. Support and secure conductors within switchboard in accordance with NFPA 70.

E. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.5 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Mimic Bus:

1. Entire single-line switchboard bus work, as depicted on factory record drawing, on minimum 0.032 inch (0.813 mm) thick anodized aluminum photoengraved nameplate, located at eye level on front cover of switchboard incoming service section.
2. Entire single-line switchboard bus work, as depicted on factory record drawing, on engraved minimum 0.0625 inch (1.588 mm) thick laminated-plastic (Gravoply) nameplate, located at eye level on front cover of switchboard incoming service section.
3. Continuously integrated mimic bus factory applied to front of switchboard. Arrange in single-line diagram format, using symbols and letter designations consistent with final mimic-bus diagram.
4. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce concise visual presentation of principal switchboard components and connections.
5. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

E. Service Equipment Label (where applicable): Labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

3.6 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Acceptance Testing:

a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment in accordance with NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Perform the following infrared scan tests and inspections, and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each switchboard. Remove **front and rear** (Where applicable) panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Nonconforming Work:

1. Switchboard will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Collect, assemble, and submit test and inspection reports, including certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges **as specified in Section 260573.16 "Coordination Studies."**

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature in accordance with manufacturer's published instructions, until switchboard is ready to be energized and placed into service.

END OF SECTION 262413

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Disconnecting and overcurrent protective devices.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

A. GFEP: Ground-fault equipment protection.

B. MCCB: Molded-case circuit breaker.

C. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.
4. Disconnecting and overcurrent protective devices.
5. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
6. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Key interlock scheme drawing and sequence of operations.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.[**Submit final versions after load balancing.**

B. Manufacturers' Published Instructions: Record copy of official installation **and testing** instructions issued to Installer by manufacturer for the following:

1. Recommended procedures for installing panelboards.
2. Recommended torque settings for bolted connections on panelboards.
3. Recommended temperature range for energizing panelboards.

C. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. **Include the following:**

1. Keys: **Two** spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: **Two** spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to panelboards, that are packaged with

protective covering for storage on-site and identified with labels describing contents. **Include the following:**

1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
2. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation in accordance with **NEMA PB 1**.

1.8 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed panelboards perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: **Two** years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS.

A. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: **Flush and Surface**-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: UL 50E, **Type 1**.
b. Outdoor Locations: UL 50E, **Type 3R**.
c. **Kitchen** and **Wash-Down** Areas: UL 50E, **Type 4X**.

d. Other Wet or Damp Indoor Locations: UL 50E, **Type 4**.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, **Type 12**.

2. Height: 7 ft (2.13 m) maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims must cover live parts and may have no exposed hardware.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: **Steel and galvanized steel**, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: **Galvanized steel**.

G. Incoming Mains:

1. Location: **Convertible between top and bottom**.
2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.

H. Phase, Neutral, and Ground Buses:

1. Material: **Hard-drawn copper, 98 percent conductivity**.

a. Plating must run entire length of bus.
b. Bus must be fully rated for entire length.

2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
5. Do not mount neutral bus in gutter.
6. Split Bus: Vertical buses divided into individual vertical sections.

I. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: **Hard-drawn copper, 98 percent conductivity**.
2. Terminations must allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: **Mechanical** type, with lug on neutral bar for each pole in panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with lug on bar for each pole in panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

J. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

K. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: **10** percent.

L. Panelboard Short-Circuit Current Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.

a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Listing Criteria: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than [**36 inch (914 mm)**] high, provide two latches, keyed alike.

D. Mains: C**ircuit breaker** or **Lugs only as shown on drawings**.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: **Bolt-on circuit breakers** or **Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal**.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: **Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal**.

G. Contactors in Main Bus: NEMA ICS 2, Class A, **electrically** held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: **Circuit breaker or lugs only** per drawings.

D. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, **electrically** or **mechanically** held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

F. Doors: Door-in-door construction with concealed hinges; secured with **flush** latch with tumbler lock; keyed alike. **Outer door must permit full access to panel interior. Inner door must permit access to breaker operating handles and labeling, but current carrying terminals and bus must remain concealed.**

G. Column-Type Panelboards: Single row of overcurrent devices **with narrow gutter extension**] **and overhead junction box equipped with ground and neutral terminal buses**.

1. Column-Type Panelboard Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

2.4 LOAD CENTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Listing Criteria: Comply with UL 67.

C. Mains: **Circuit breaker or lugs only** per drawings.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.

F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. MCCB: Comply with UL 489, with **interrupting capacity** to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

   a. Inverse time-current element for low-level overloads.
   b. Instantaneous magnetic trip element for short circuits.
   c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

   a. RMS sensing.
   b. Field-replaceable rating plug or electronic trip.
   c. Digital display of settings, trip targets, and indicated metering displays.
   d. Multi-button keypad to access programmable functions and monitored data.
   e. Ten-event, trip-history log. Each trip event must be recorded with type, phase, and magnitude of fault that caused trip.
   f. Integral test jack for connection to portable test set or laptop computer.
   g. Field-Adjustable Settings:

      1) Instantaneous trip.
      2) Long- and short-time pickup levels.
      3) Long and short time adjustments.
      4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30 mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240 V, single-pole configuration.

8. Subfeed Circuit Breakers: Vertically mounted.
9. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.
    d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    f. Ground-Fault Protection: i**ntegrally mounted** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    g. Communication Capability: **Circuit-breaker-mounted Integral** communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
    h. Shunt Trip: **120 V** trip coil energized from separate circuit, set to trip at **75** percent of rated voltage.
    i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in **on or off** position.
    j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
    k. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage **with field-adjustable 0.1- to 0.6-second** time delay.
    l. Rating Plugs: Three-pole breakers with ampere ratings greater than [**150**] <**Insert value**> A must have interchangeable rating plugs or electronic adjustable trip units.
    m. Auxiliary Contacts: **One, SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    n. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    o. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key must be removable only when circuit breaker is in off position.
    p. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    q. Multipole units enclosed in **single housing with single handle or factory assembled to operate as single unit**.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories:

    a. Standard ampere ratings and number of poles.
    b. Mechanical cover interlock with manual interlock override, to prevent opening of cover when switch is in on position. Interlock must prevent switch from being turned on with cover open. Operating handle must have lock-off means with provisions for three padlocks.
    c. Auxiliary Contacts: **One** normally open and normally closed contact(s) that operate with switch handle operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards in accordance with **NECA 407** abd **NEMA PB 1.1**.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with **NEMA PB 1.1**.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Equipment Mounting:

   a. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
   b. Attach panelboard to vertical finished or structural surface behind panelboard.
   c. Mount surface-mounted panelboards to steel slotted supports **5/8 inch (16 mm)** in depth. Orient steel slotted supports vertically.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
3. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
4. Mount top of trim **7.5 ft (2.3 m)** above finished floor unless otherwise indicated.
5. Mount panelboard cabinet plumb and rigid without distortion of box.
6. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
7. Install overcurrent protective devices and controllers not already factory installed.

   a. Set field-adjustable, circuit-breaker trip ranges.

b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.

8. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
9. Install filler plates in unused spaces.
10. Stub four 1 inch (25 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 inch (25 mm) empty conduits into raised floor space or below slab not on grade.
11. Arrange conductors in gutters into groups and bundle and wrap with wire ties **after completing load balancing**.
12. Mount spare fuse cabinet in accessible location.

D. Interfaces with Other Work:

1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.

F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.

G. Circuit Directory:

1. Provide directory card inside panelboard door, mounted in **metal frame with transparent protective cover**.

a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3. Create directory to indicate installed circuit loads **after balancing panelboard loads**; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

C. Tests and Inspections:
1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
2. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Nonconforming Work:

1. Panelboards will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

E. Collect, assemble, and submit test and inspection reports, including certified report that identifies panelboards included and that describes scanning results, with comparisons of two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges **as specified in Section 260573.16 "Coordination Studies."**

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within panelboard, may not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION 262416

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SECTION 262716 - ELECTRICAL CABINETS AND ENCLOSURES

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

Content Requests:

<Double click here to submit questions, comments, or suggested edits to this Section.>

Revise this Section by deleting and inserting text to meet Project-specific requirements.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.
4. Rack or frame systems.
5. Enclosure-mounted relocatable power taps.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for equipment labels.

C. Related Requirements:

Always retain two subparagraphs below.

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

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1.2 DEFINITIONS

~~Do not duplicate common acronyms, abbreviations, and terms defined in Section 260010 "Supplemental Requirements for Electrical."~~

~~Retain terms that remain after this Section has been edited for a project. Include only essential definitions or acronyms not well understood by the affected industry or trade.~~

A. RBB: Rack bonding busbar, located in equipment cabinets and racks.

1.3 ACTION SUBMITTALS

~~Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.~~

A. Product Data:

~~Retain one or more of five subparagraphs below as needed to verify compliance of Work with Project requirements.~~

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.
4. Rack or frame systems.
5. ~~Enclosure-mounted relocatable power taps.~~

B. Shop Drawings:

~~Retain one or more of two subparagraphs below as needed to verify compliance of Work with Project requirements.~~

1. Shop drawings for custom enclosures and cabinets.
2. Shop drawings for racks or frames.

1.4 INFORMATIONAL SUBMITTALS

~~Informational submittals are submittals that require review by Architect, but they do not require Architect's responsive action and return of reviewed documents to Contractor, provided submittals comply with requirements. If rejected, submittals with responsive action must be returned to Contractor.~~

A. Manufacturers' Published Instructions:

Retain one or more of five subparagraphs below as needed to verify compliance of Work with Project requirements.

1. Cabinets and cutout boxes.
2. Termination boxes.
3. Miscellaneous enclosures.
4. Rack or frame systems.
5. ~~Enclosure-mounted relocatable power taps.~~

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PART 2 - PRODUCTS

~~Manufacturers and products listed in this Section are neither recommended nor endorsed by the AIA or Deltek. Before selecting manufacturers and products, verify availability, suitability for intended applications, and compliance with minimum performance requirements. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."~~

~~Product options commonly available from manufacturers are included in square brackets throughout the Section Text. Not every manufacturer listed can provide every option offered; verify availability with manufacturers. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."~~

2.1 CABINETS AND CUTOUT BOXES

A. Performance Criteria:

1. Regulatory Requirements:

~~a.~~ Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

~~b.~~a. ~~<**Insert requirements**>.~~

2. Listing Criteria:

~~For assistance with finding guide information for UL Category Control Numbers and identifying UL-approved manufacturers, consult the UL Product iQ database at https://iq.ulprospector.com/.~~

a. UL CCN CYIV.
b. Non-Environmental Characteristics: UL 50.
c. Environmental Characteristics: UL 50E.

B. Source Quality Control:

~~Coordinate "Product Data" Subparagraph below with "Action Submittals" Article.~~

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

~~Retain "Manufacturer's Published Instructions" Subparagraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate subparagraph with "Informational Submittals" Article.~~

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

~~Copy and revise first paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

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C. UL CYIV - Indoor Sheet Metal Cabinets ~~<**Insert drawing designation**>~~:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. N J Sullivan Company.
h. Robroy Enclosures; Robroy Industries.
i. Siemens Industry, Inc., Building Technologies Division.
j. Square D; Schneider Electric USA.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2. General Characteristics: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

3. Options:

a. Degree of Protection: [**Type 1**] ~~[**Type 2**] [**Type 5**] [**Type 12**] [**Type 12K**] [**Type 13**]~~.

~~Copy and revise first paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

D. UL CYIV - Indoor Sheet Metal Cutout Boxes ~~<**Insert drawing designation**>~~:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Milbank Manufacturing Company.
h. N J Sullivan Company.
i. Robroy Enclosures; Robroy Industries.
j. Siemens Industry, Inc., Building Technologies Division.
k. Square D; Schneider Electric USA.

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~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2. General Characteristics: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

3. Options:

a. Degree of Protection: ~~[~~**Type 1**~~] [Type 2] [Type 5] [Type 12] [Type 12K] [Type 13]~~.

~~Copy and revise first paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

E. UL CYIV - Outdoor Sheet Metal Cabinets ~~<**Insert drawing designation**>~~:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Crouse-Hinds; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. Killark; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
g. Milbank Manufacturing Company.
h. N J Sullivan Company.
i. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
j. Robroy Enclosures; Robroy Industries.
k. Siemens Industry, Inc., Building Technologies Division.
l. Square D; Schneider Electric USA.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2. General Characteristics: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

3. Options:

a. Degree of Protection: ~~[Type 3] [Type 3X] [~~**Type 3R**~~] [Type 3RX] [Type 3S] [Type 3SX] [Type 4] [Type 4X] [Type 6] [Type 6P]~~.

~~Copy and revise paragraph below for each configuration indicated on Drawings.~~

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~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

~~F. UL CYIV - Outdoor Sheet Metal Cutout Boxes <**Insert drawing designation**>:~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~
~~2. General Characteristics: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.~~

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

~~3. Options:~~

~~a. Degree of Protection: [**Type 3**] [**Type 3X**] [**Type 3R**] [**Type 3RX**] [**Type 3S**] [**Type 3SX**] [**Type 4**] [**Type 4X**] [**Type 6**] [**Type 6P**].~~

2.2 TERMINATION BOXES

A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

~~2.~~ Listing Criteria:

2. ~~For assistance with finding guide information for UL Category Control Numbers and identifying UL-approved manufacturers, consult the UL Product iQ database at https://iq.ulprospector.com/.~~

a. UL CCN XCKT; including UL 1773.
b. Non-Environmental Characteristics: UL 50.
c. Environmental Characteristics: UL 50E.

C. Source Quality Control:

~~Coordinate "Product Data" Subparagraph below with "Action Submittals" Article.~~

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

~~Retain "Manufacturer's Published Instructions" Subparagraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate subparagraph with "Informational Submittals" Article.~~

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2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

~~Copy and revise first paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

D. UL XCKT - Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment ~~<**Insert drawing designation**>~~:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. N J Sullivan Company.
g. Square D; Schneider Electric USA.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

2. Additional Characteristics: Listed and labeled for installation on line side of service equipment.

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

3. Options:

a. Indoor Degree of Protection: ~~[~~**Type 1**~~] [Type 2] [Type 5] [Type 12] [Type 12K] [Type 13]~~.
b. Outdoor Degree of Protection: ~~[Type 3] [Type 3X]~~ [**Type 3R**~~] [Type 3RX] [Type 3S] [Type 3SX] [Type 4] [Type 4X] [Type 6] [Type 6P]~~.

~~Copy and revise paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

~~E. UL XCKT - Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment <**Insert drawing designation**>:~~

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~
~~2. Additional Characteristics: Listed and labeled for installation on load side of service equipment.~~

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

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3. Options:

a. Indoor Degree of Protection: [**Type 1**] [**Type 2**] [**Type 5**] [**Type 12**] [**Type 12K**] [**Type 13**].
b. Outdoor Degree of Protection: [**Type 3**] [**Type 3X**] [**Type 3R**] [**Type 3RX**] [**Type 3S**] [**Type 3SX**] [**Type 4**] [**Type 4X**] [**Type 6**] [**Type 6P**].

2.3 MISCELLANEOUS ENCLOSURES

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

Retain first subparagraph below to require enclosures to be listed and labeled as termination boxes suitable for field-installed termination bases. UL 1773 is technically not required, but there is no other UL category control number for evaluating miscellaneous enclosures.

For assistance with finding guide information for UL Category Control Numbers and identifying UL-approved manufacturers, consult the UL Product iQ database at https://iq.ulprospector.com/.

a. UL CCN XCKT; including UL 1773.
b. Non-Environmental Characteristics: UL 50.
c. Environmental Characteristics: UL 50E.

B. Source Quality Control:

Coordinate "Product Data" Subparagraph below with "Action Submittals" Article.

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

Retain "Manufacturer's Published Instructions" Subparagraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate subparagraph with "Informational Submittals" Article.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

Copy and revise first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

C. UL XCKT - Indoor Sheet Metal Miscellaneous Enclosures <**Insert drawing designation**>:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

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a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. N J Sullivan Company.
g. Square D; Schneider Electric USA.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

2. Options:

a. Degree of Protection: ~~[~~**Type 1**~~] [Type 2] [Type 5] [Type 12] [Type 12K] [Type 13]~~.

~~Copy and revise paragraph below for each configuration indicated on Drawings.~~

~~Insert drawing designation. Use these designations on Drawings to identify each product.~~

D. UL XCKT - Outdoor Sheet Metal Miscellaneous Enclosures <**Insert drawing designation**>:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. Appleton; Emerson Electric Co., Automation Solutions.
c. Cooper B-line; brand of Eaton, Electrical Sector.
d. Erickson Electrical Equipment Company.
e. Hoffman; brand of nVent Electrical plc.
f. N J Sullivan Company.
g. Square D; Schneider Electric USA.

~~1. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~Retain "Options" Subparagraph below to require all products to be same degree of protection. To permit different degrees of protection for different applications or locations, specify type on Drawings or specify selection criteria in Part 3.~~

2. Options:

a. Degree of Protection: ~~[Type 3] [Type 3X] [~~**Type 3R**~~] [Type 3RX] [Type 3S] [Type 3SX] [Type 4] [Type 4X] [Type 6] [Type 6P]~~.

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2.4 RACK OR FRAME SYSTEMS

A. Description: This category covers rack or frame systems that are not complete but include components and assemblies that are intended to power, protect, heat, cool, or otherwise support electrical or electronic equipment that will be installed at a later time.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

For assistance with finding guide information for UL Category Control Numbers and identifying UL-approved manufacturers, consult the UL Product iQ database at https://iq.ulprospector.com/.

a. UL CCN NWIN; including UL 2416.
b. Non-Environmental Characteristics: UL 50.
c. Environmental Characteristics: UL 50E or UL 2416.

C. Source Quality Control:

Coordinate "Product Data" Subparagraph below with "Action Submittals" Article.

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

Retain "Manufacturer's Published Instructions" Subparagraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate subparagraph with "Informational Submittals" Article.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

Retain "UL NWIN - 19 Inch Open Equipment Rack" Paragraph below to specify floor- and wall-mounted equipment racks that are not enclosed. To specify enclosed cabinets, retain "UL NWIN - 19 Inch Enclosed Equipment Rack" Paragraph.

Copy and revise first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

D. UL NWIN - 19 Inch Open Equipment Rack <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. General Characteristics:

a. Threaded rails designed for mounting telecommunications equipment.

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nt.

b. Width: Compatible with EIA/ECIA 310-E, 19 inch (482.6 mm) equipment mounting with an opening of 17.72 inch (450 mm) between rails.
c. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
d. Finish: Manufacturer's standard, baked-polyester powder coat.
e. Cable Management:

1) Metal, with integral wire retaining fingers.
2) Baked-polyester powder coat finish.
3) Vertical cable management panels have front and rear channels with covers.
4) Horizontal crossover cable manager at top of each relay rack, with minimum height of two rack units each.

3. Options:

a. Configuration: [**Two-post**] [**and**] [**four-post**].
b. Material: [**Extruded steel**] [**Extruded aluminum**] [**Sheet steel**] [**Sheet aluminum**].
c. Color: [**Black**] <**Insert color**>.

Verify options in "Floor-Mounted Racks" Subparagraph below with rack manufacturer.

d. Floor-Mounted Racks:

1) Overall Height: [**72 inch (1828.8 mm)**] [**84 inch (2133.6 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Overall Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Rail Depth: [**3 inch (76.2 mm)**] [**6 inch (152.4 mm)**] <**Insert value**>.
4) Two-Post Load Rating: [**200 lb (91 kg)**] [**400 lb (181 kg)**] <**Insert value**>.
5) Four-Post Load Rating: [**1000 lb (454 kg)**] [**2000 lb (907 kg)**] <**Insert value**>.
6) Number of Rack Units per Rack: [**38**] [**42**] [**45**] [**52**] [**58**] [**As indicated on Drawings**] <**Insert number**>.

"Numbering" Subparagraph below may describe a feature not available from all manufacturers.

a) Numbering: [**Every**] [**Every five**] rack unit(s), on interior of rack.

7) Threads: [**10-32**] [**12-24**] [**Universal square**].
8) Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[**, and a power strip**].
9) Base must have minimum four mounting holes for permanent attachment to floor.
10) Top must have provisions for attaching to cable tray or ceiling.
11) Self-leveling.

Verify options in "Wall-Mounted Racks" Subparagraph below with rack manufacturer.

e. Wall-Mounted Racks:

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1) Height: [**18 inch (457.2 mm)**] [**22 inch (558.8 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Load Rating: [**150 lb (65 kg)**] [**200 lb (91 kg)**] <**Insert value**>.
4) Number of Rack Units per Rack: [**8**] [**12**] [**22**] [**As indicated on Drawings**] <**Insert number**>.
5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Wall Attachment: Four pre-punched mounting holes.

"Equipment Access" Subparagraph below is for an option that may not be available from all manufacturers.

7) Equipment Access: Integral swing.

Copy and revise first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

E. UL NWIN - 19 Inch Enclosed Equipment Rack <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. General Characteristics:

a. Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment.
b. Threaded rails designed for mounting telecommunications equipment.
c. Width: Compatible with EIA/ECIA 310-E, 19 inch (482.6 mm) equipment mounting with an opening of 17.72 inch (450 mm) between rails.
d. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
e. Finish: Manufacturer's standard, baked-polyester powder coat.
f. Cable Management:

1) Metal, with integral wire retaining fingers.
2) Baked-polyester powder coat finish.
3) Vertical cable management panels have front and rear channels with covers.
4) Horizontal crossover cable manager at top of each relay rack, with minimum height of two rack units each.

3. Options:

a. Material: [**Extruded steel**] [**Extruded aluminum**] [**Sheet steel**] [**Sheet aluminum**].
b. Color: [**Black**] <**Insert color**>.
c. Modular Freestanding Cabinets:

1) Overall Height: [**72 inch (1828.8 mm)**] [**84 inch (2133.6 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Overall Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Load Rating: [**3000 lb (1362 kg)**] <**Insert value**>.

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4) Number of Rack Units: [**38**] [**42**] [**45**] [**52**] [**58**] [**As indicated on Drawings**] <**Insert number**>.

"Numbering" Subparagraph below may describe a feature not available from all manufacturers.

a) Numbering: [**Every**] [**Every five**] rack unit(s), on interior of rack.

5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Removable and lockable side and top panels.
7) Hinged and lockable front and rear doors.
8) Adjustable feet for leveling.
9) Screened ventilation openings in roof and rear door.
10) Cable access provisions in roof and base.
11) RBB.
12) [**Rack**] [**Roof**]-mounted, 550 cfm (260 L/s) fan with filter.
13) Power strip.
14) All cabinets keyed alike.

d. Modular Wall Cabinets:

1) Height: [**18 inch (457.2 mm)**] [**22 inch (558.8 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Load Rating: [**150 lb (65 kg)**] [**200 lb (91 kg)**] <**Insert value**>.
4) Number of Rack Units: [**8**] [**12**] [**22**] [**As indicated on Drawings**] <**Insert number**>.
5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Lockable front[**and rear**] doors.
7) Louvered side panels.
8) Cable access provisions top and bottom.
9) Grounding lug.
10) [**Rack**] [**Roof**]-mounted, 250 cfm (118 L/s) fan.
11) Power strip.
12) All cabinets keyed alike.

Retain "UL NWIN - 23 Inch Open Equipment Rack" Paragraph below to specify floor- and wall-mounted equipment racks that are not enclosed. To specify enclosed cabinets, retain "UL NWIN - 23 Inch Enclosed Equipment Rack" Paragraph.

Copy and revise first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

F. UL NWIN - 23 Inch Open Equipment Rack <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. General Characteristics:

a. Threaded rails designed for mounting telecommunications equipment.
b. Width: Compatible with 23 inch (584.2 mm) equipment mounting.

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nt.

c. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
d. Finish: Manufacturer's standard, baked-polyester powder coat.
e. Cable Management:

1) Metal, with integral wire retaining fingers.
2) Baked-polyester powder coat finish.
3) Vertical cable management panels have front and rear channels with covers.
4) Horizontal crossover cable manager at top of each relay rack, with minimum height of two rack units each.

3. Options:

a. Configuration: [**Two post**] [**and**] [**four post**].
b. Material: [**Extruded steel**] [**Extruded aluminum**] [**Sheet steel**] [**Sheet aluminum**].
c. Color: [**Black**] <**Insert color**>.

Verify options in "Floor-Mounted Racks" Subparagraph below with rack manufacturer.

d. Floor-Mounted Racks:

1) Overall Height: [**72 inch (1828.8 mm)**] [**84 inch (2133.6 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Overall Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Rail Depth: [**3 inch (76.2 mm)**] [**6 inch (152.4 mm)**] <**Insert value**>.
4) Two-Post Load Rating: [**200 lb (91 kg)**] [**400 lb (181 kg)**] <**Insert value**>.
5) Four-Post Load Rating: [**1000 lb (454 kg)**] [**2000 lb (907 kg)**] <**Insert value**>.
6) Number of Rack Units per Rack: [**38**] [**42**] [**45**] [**52**] [**58**] [**As indicated on Drawings**] <**Insert number**>.

"Numbering" Subparagraph below may describe a feature not available from all manufacturers.

a) Numbering: [**Every**] [**Every five**] rack unit(s), on interior of rack.

7) Threads: [**10-32**] [**12-24**] [**Universal square**].
8) Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[**, and a power strip**].
9) Base must have minimum four mounting holes for permanent attachment to floor.
10) Top must have provisions for attaching to cable tray or ceiling.
11) Self-leveling.

Verify options in "Wall-Mounted Racks" Subparagraph below with rack manufacturer.

e. Wall-Mounted Racks:

1) Height: [**18 inch (457.2 mm)**] [**22 inch (558.8 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.

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3) Load Rating: [**150 lb (65 kg)**] [**200 lb (91 kg)**] <**Insert value**>.
4) Number of Rack Units per Rack: [**8**] [**12**] [**22**] [**As indicated on Drawings**] <**Insert number**>.
5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Wall Attachment: Four pre-punched mounting holes.

"Equipment Access" Subparagraph below is for an option that may not be available from all manufacturers.

7) Equipment Access: Integral swing.

Copy and revise first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

G. UL NWIN - 23 Inch Enclosed Equipment Rack <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. General Characteristics:

a. Manufacturer-assembled four-post frame enclosed by side and top panels and front and rear doors, designed for mounting telecommunications equipment.
b. Threaded rails designed for mounting telecommunications equipment.
c. Width: Compatible with 23 inch (584.2 mm) equipment mounting.
d. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
e. Finish: Manufacturer's standard, baked-polyester powder coat.
f. Cable Management:

1) Metal, with integral wire retaining fingers.
2) Baked-polyester powder coat finish.
3) Vertical cable management panels have front and rear channels with covers.
4) Horizontal crossover cable manager at top of each relay rack, with minimum height of two rack units each.

3. Options:

a. Material: [**Extruded steel**] [**Extruded aluminum**] [**Sheet steel**] [**Sheet aluminum**].
b. Color: [**Black**] <**Insert color**>.
c. Modular Freestanding Cabinets:

1) Overall Height: [**72 inch (1828.8 mm)**] [**84 inch (2133.6 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Overall Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Load Rating: [**3000 lb (1362 kg)**] <**Insert value**>.
4) Number of Rack Units: [**38**] [**42**] [**45**] [**52**] [**58**] [**As indicated on Drawings**] <**Insert number**>.

"Numbering" Subparagraph below may describe a feature not available from all manufacturers.

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a) Numbering: [**Every**] [**Every five**] rack unit(s), on interior of rack.

5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Removable and lockable side and top panels.
7) Hinged and lockable front and rear doors.
8) Adjustable feet for leveling.
9) Screened ventilation openings in roof and rear door.
10) Cable access provisions in roof and base.
11) RBB.
12) [**Rack**] [**Roof**]-mounted, 550 cfm (260 L/s) fan with filter.
13) Power strip.
14) All cabinets keyed alike.

d. Modular Wall Cabinets:

1) Height: [**18 inch (457.2 mm)**] [**22 inch (558.8 mm)**] [**As indicated on Drawings**] <**Insert value**>.
2) Depth: [**23 inch (584.2 mm)**] [**29 inch (736.6 mm)**] <**Insert value**>.
3) Load Rating: [**150 lb (65 kg)**] [**200 lb (91 kg)**] <**Insert value**>.
4) Number of Rack Units: [**8**] [**12**] [**22**] [**As indicated on Drawings**] <**Insert number**>.
5) Threads: [**10-32**] [**12-24**] [**Universal square**].
6) Lockable front[**and rear**] doors.
7) Louvered side panels.
8) Cable access provisions top and bottom.
9) Grounding lug.
10) [**Rack**] [**Roof**]-mounted, 250 cfm (118 L/s) fan.
11) Power strip.
12) All cabinets keyed alike.

2.5 ENCLOSURE-MOUNTED RELOCATABLE POWER TAPS

A. Description: This category covers relocatable power taps rated 250 V(ac) or less, 20 A or less, and intended to supply power to cord-and-plug-connected electrical utilization equipment located inside cabinets, enclosures, and racks.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

For assistance with finding guide information for UL Category Control Numbers and identifying UL-approved manufacturers, consult the UL Product iQ database at https://iq.ulprospector.com/.

2. Listing Criteria: UL CCN XBYS; including UL 1363.

C. Source Quality Control:

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Coordinate "Product Data" Subparagraph below with "Action Submittals" Article.

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

Retain "Manufacturer's Published Instructions" Subparagraph below when execution requirements state "in accordance with manufacturer's published instructions," especially if those instructions may require preinstallation review and coordination with Construction Documents to verify constructability and commissioning requirements. Coordinate subparagraph with "Informational Submittals" Article.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

Copy and re-edit paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

D. UL XBYS - Enclosure-Mounted Relocatable Power Tap <**Insert drawing designation**>:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. General Characteristics:

a. Rocker-type on-off switch, illuminated when in on position.
b. LED indicator lights for power and protection status.
c. LED indicator lights for reverse polarity and open outlet ground.

3. Options:

a. Wiring Devices: [**Six**] <**Insert quantity**> [**5-15R**] [**5-20R**] <**Insert type**> receptacles.
b. Circuit Breaker and Thermal Fusing: [**When protection is lost, circuit opens and cannot be reset**] [**Unit continues to supply power if protection is lost**].
c. Cord Length: [**Close-coupled, direct plug-in**] [**15 ft (4.5 m)**].
d. Surge Protection: Type 3 SPDs.

Retain subparagraphs below if power strips contain surge protection. In first subparagraph, retain first option for high exposure and cost, second option for medium exposure and cost, and third option for low exposure and cost.

1) Peak Single-Impulse Surge Current Rating: [**33**] [**26**] [**13**] kA per phase.
2) Protection modes must be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all three modes may not be more than [**330 V**] <**Insert value**>.

PART 3 - EXECUTION

3.1 PREPARATION

Coordinate "Shop Drawings" Paragraph below with "Action Submittals" Article. Shop drawings may include multi-system and interdisciplinary coordination drawings.

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A. Shop Drawings: Prepare and submit the following:

~~Retain "Shop Drawings for Custom Enclosures and Cabinets" Subparagraph below for custom enclosures and where location of floor boxes is critical.~~

1. Shop Drawings for Custom Enclosures and Cabinets: Include plans, elevations, sections, and attachment details.
2. Shop Drawings for Racks or Frames:

    a. Include plans, elevations, sections, details, and attachments to other work.
    b. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    c. Include workspace requirements and access for cable connections.
    d. Grounding: Indicate location of RBB and its mounting detail showing standoff insulators and wall-mounting brackets.

3.2 SELECTION OF ELECTRICAL CABINETS AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of electrical cabinets and enclosures. Consult Architect for resolution of conflicting requirements.

~~Retain "Degree of Protection" Paragraph below if information is not specified on Drawings or in Part 2. Revise options as necessary to limit freedom of Contractor to select available products to suit Project.~~

B. Degree of Protection:

~~See NFPA 70, Paragraph 110.28; UL 50; and UL 50E for additional information on degree of protection types for enclosures. Most readily available enclosure types are Types 1, 4, 4X, and dual-rated 3R/12; however, all types are available.~~

1. Outdoors:

~~Types 3, 3S, 3SX, 3X, 4*, 4X*, 5, 6*, 6P*, 12, 12K, and 13 can be marked "Dusttight." (*The optional marking for these types is new for the 2020 edition of NFPA 70 and has not yet been incorporated into UL 50 and UL 50E.)~~

~~Retain Type 4 or Type 3 option in first subparagraph below if Project site is subject to windblown dust. Type 3R is rainproof; Type 4 is watertight; Type 3 is raintight.~~

    a. ~~[~~**Type 3R**~~] [Type 4] [Type 3]~~ unless otherwise indicated.
    b. Locations Exposed to Hosedown: ~~[~~**Type 4**~~] [Type 6] [Type 6P]~~.
    c. Locations Subject to Potential Flooding: Type 6P.
    d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
    e. Locations in-Ground or Exposed to Corrosive Agents: ~~[~~**Type 4X**~~] [Type 6P] [Type 3RX]~~.
    f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.

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2. Indoors:

a. Type 1 unless otherwise indicated.
b. Damp or Dusty Locations: [**Type 12**] ~~[Type 2] [Type 4] [Type 5]~~.
c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: [**Type 12**] ~~[Type 12K]~~.
e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: [**Type 4**] ~~[Type 6]~~.
f. Locations Exposed to Hosedown: [**Type 4**] ~~[Type 6] [Type 6P]~~.
g. Locations Exposed to Brief Submersion: [**Type 6**] ~~[Type 6P]~~.
h. Locations Exposed to Prolonged Submersion: Type 6P.
i. Locations Exposed to Corrosive Agents: [**Type 4X**] ~~[Type 6P]~~.
j. Locations Exposed to Spraying Oil or Coolants: Type 13.

3.3 INSTALLATION OF ELECTRICAL CABINETS AND ENCLOSURES

A. Comply with manufacturer's published instructions.

~~NFPA 70 and NECA NEIS 1 are already specified in Section 260010 "Supplemental Requirements for Electrical." Retain "Reference Standards for Installation" Paragraph below to specify other standards applicable to Work specified in this Section.~~

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Cabinets and Cutout Boxes: Article 312 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Mount cabinets and enclosures at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to [**center**] ~~[top] [bottom]~~ of box unless otherwise indicated.
2. Do not install cabinets, enclosures, or fittings in contact with concrete or earth.
3. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
4. Identification: Provide labels for cabinets, enclosures, racks and associated electrical equipment.

a. Identify field-installed conductors, interconnecting wiring, and components.
b. Provide warning signs.
c. Label each cabinet, enclosure, and rack with engraved metal or laminated-plastic nameplate.

D. Interfaces with Other Work:

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~~1. Coordinate installation of new products for <**Insert system or product family/category**> with existing conditions.~~

~~a. <**Insert requirements for transition between new and existing**>.~~

~~2.~~1. Coordinate with Section 078413 "Penetration Firestopping" for installation of sealants.
~~3.~~2. Grounding and Bonding:

a. Cabinets, Enclosures, and Racks for Electrical Systems: Coordinate with Section 260526 "Grounding and Bonding for Electrical Systems" for grounding of RBBs.
b. Cabinets, Enclosures, and Racks for Communications Systems and Electronic Safety and Security Systems: Coordinate with Section 260526 "Grounding and Bonding for Electrical Systems" for grounding of RBBs.

~~4.~~3. Coordinate with Section 260573.13 "Short-Circuit Studies" for determining available fault current on input feeder.
~~5.~~4. Coordinate with Section 260573.19 "Arc-Flash Hazard Analysis" for determining arc-flash hazard on input feeder.
~~6. Coordinate with <**Insert Section number and title**> for <**Insert description of interfacing related Work**>.~~

~~a. <**Insert requirements for transition between this Section and related Work**>.~~

3.4 CLEANING

A. Remove construction dust and debris from cabinets, enclosures, and racks.

3.5 PROTECTION

A. Protect coatings and finishes of cabinets, enclosures, and racks from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 262716

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with arc-fault and ground-fault protective devices.
4. Locking receptacles.
5. Connectors, cords, and plugs.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260923 "Lighting Control Devices" for occupancy sensors, timers, control-voltage switches, and control-voltage dimmers.

1.2 ALLOWANCES

A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 UNIT PRICES

A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.4 ALTERNATES

A. See Section 012300 "Alternates" for description of alternates affecting items specified in this Section.

1.5 DEFINITIONS

A. Commercial/Industrial-Use Cord Reel: A cord reel subject to severe use in factories, commercial garages, construction sites, and similar locations requiring a harder service-type cord.

B. UL 1472 Type I Dimmer: Dimmer in which air-gap switch is used to energize preset lighting levels.

1.6 ACTION SUBMITTALS

A. Product Data:

1. General-use switches, dimmer switches, and fan-speed controller switches.
2. General-grade duplex straight-blade receptacles.
3. Receptacles with arc-fault and ground-fault protective devices.
4. Locking receptacles.
5. Connectors, cords, and plugs.

B. Shop Drawings:

1. Wiring diagrams for duplex straight-blade receptacles with integral switching means.

C. Samples:

1. One for each kind of toggle switch **and cover plate accessory** specified, in each finish and color specified.
2. One for each kind of key lock switch **and cover plate accessory**]specified, in each finish and color specified.
3. One for each kind of dimmer switch **and cover plate accessory** specified, in each finish and color specified.
4. One for each kind of fan-speed controller switch **and cover plate accessory** specified, in each finish and color specified.
5. One for each kind of duplex straight-blade receptacle **and cover plate accessory** specified, in each finish and color specified.
6. One for each kind of receptacle with AFCI device **and cover plate accessory** specified, in each finish and color specified.
7. One for each kind of receptacle with AFCI and GFCI devices **and cover plate accessory** specified, in each finish and color specified.
8. One for each kind of receptacle with GFCI device **and cover plate accessory** specified, in each finish and color specified.
9. One for each kind of locking receptacle **and cover plate accessory** specified, in each finish and color specified.
10. One for each kind of pin-and-sleeve receptacle specified, in each finish and color specified.
11. One for each kind of cord connector specified, in each finish and color specified.

D. Field quality-control reports.

1.7 INFORMATIONAL SUBMITTALS

A. Manufacturers' Instructions: Record copy of official installation **and testing** instructions issued to Installer by manufacturer for the following:

1. Dimmers.
2. Fan-speed controllers.
3. Duplex straight-blade receptacles.
4. Receptacles with AFCI device.
5. Receptacles with AFCI and GFCI devices.

6. Receptacles with GFCI device.
7. Locking receptacles.

B. Sample warranties.

1.8 CLOSEOUT SUBMITTALS

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Items: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Extra Keys for Key Lock Switches: **One** of each kind.
2. SPD Receptacles: Equal to **10** percent of quantity installed for each kind specified, but no fewer than **one** unit.
3. Controlled Receptacles: Equal to **10** percent of quantity installed for each kind specified, but no fewer than **one** unit.
4. Cord Connectors: **One** of each kind.

B. Special Tools:

1. Proprietary equipment and software required to maintain, repair, adjust, or implement future changes to controlled receptacles.
2. Proprietary equipment required to maintain, repair, adjust, or implement future changes to cord connectors.

1.10 WARRANTY FOR DEVICES

A. Special Manufacturer Extended Warranty: Manufacturer warrants that devices perform in accordance with specified requirements and agrees to provide repair or replacement of devices that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: **Three** years from date of Substantial Completion; **full** coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 GENERAL-USE SWITCHES, DIMMER SWITCHES, AND FAN-SPEED CONTROLLER SWITCHES

A. Toggle Switch :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
c. Leviton Manufacturing Co., Inc.

d. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN WMUZ and UL 20.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
b. Configuration:

1) General-duty, 120-277 V, 15 A, **single pole**.

5. Accessories:

a. Cover Plate: 0.060 inch (1.5 mm) thick, high-impact thermoplastic (nylon) with smooth finish and color matching wiring device; from same manufacturer as wiring device.
b. Securing Screws for Cover Plate: Metal with head color matching wallplate finish.

B. Toggle Switch with Forked Key Lock per drawings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN WMUZ and UL 20.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Verify availability of colors with manufacturers.

a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Black**] [**As indicated on architectural Drawings**].
b. Configuration:

1) 120-277 V, 15 A, **single pole**.

Copy and re-edit first paragraph below for each configuration indicated on Drawings.

Insert drawing designation. Use these designations on Drawings to identify each product.

C. Type I Dimmer Switch per drawings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. GE Lighting; a Savant Company.
c. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
d. Leviton Manufacturing Co., Inc.
e. Lutron Electronics Co., Inc.
f. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN EOYX and UL 1472 Type I dimmer.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
b. Switch Style: [**Toggle**] [**Rocker**] [**Push button**].
c. Dimming Control Style: [**Slide**] [**Rotary**].

2.2 GENERAL-GRADE DUPLEX STRAIGHT-BLADE RECEPTACLES

A. Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    b. Leviton Manufacturing Co., Inc.
    c. Pass & Seymour; Legrand North America, LLC.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

    a. Reference Standards: UL CCN RTRT and UL 498.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

    a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
    b. Configuration:
        1) Heavy-duty, **NEMA 5-20R**.
        2) Heavy-duty, **NEMA 5-20R**; **with one USB-A port and One USB-C port where applicable**
        3) Heavy-duty, smooth face, **NEMA 5-20R**.

B. Tamper-Resistant Duplex Straight-Blade Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    b. Leviton Manufacturing Co., Inc.
    c. Pass & Seymour; Legrand North America, LLC.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
b. Configuration:
   1) Heavy-duty, **NEMA 5-20R**.
   2) Heavy-duty, smooth face, **NEMA 5-20R**.

2.3 RECEPTACLES WITH ARC-FAULT AND GROUND-FAULT PROTECTIVE DEVICES

A. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

   a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

   a. Reference Standards: UL CCN AWBZ, UL 498, UL 1699, and UL Subject 1699A.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

   a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
   b. Configuration: Heavy-duty, [**NEMA 5-15R**] [**NEMA 5-20R**].

B. General-Grade, Tamper-Resistant Duplex Straight-Blade Receptacle with AFCI and GFCI Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    b. Leviton Manufacturing Co., Inc.
    c. Pass & Seymour; Legrand North America, LLC.
    d. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

    a. Reference Standards: UL CCN KCXX, UL 498, UL 943, UL 1699, and UL Subject 1699A.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

    a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
    b. Configuration: Heavy-duty, [**NEMA 5-15R**] [**NEMA 5-20R**].

C. General-Grade, Weather-Resistant, Tamper-Resistant Duplex Straight-Blade Receptacle with GFCI Device:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
    b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
    c. Leviton Manufacturing Co., Inc.
    d. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

    a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

    a. Reference Standards: UL CCN KCXS, UL 498, and UL 943.

4. Options:

Coordinate "Device Color" Subparagraph below with architectural requirements. Blue, green, office white, almond, and light almond are not defined in NEMA WD 1, so the same color from different manufacturers may not match. Verify availability of colors with manufacturers.

a. Device Color: [**Ivory**] [**White**] [**Gray**] [**Brown**] [**Black**] [**Red**] [**Yellow**] [**Orange**] [**in accordance with NEMA WD 1**] [**Blue**] [**Green**] [**Office White**] [**Almond**] [**Light Almond**] [**As indicated on architectural Drawings**].
b. Configuration: Heavy-duty, [**NEMA 5-15R**] [**NEMA 5-20R**].

2.4 LOCKING RECEPTACLES

A. NEMA, 125 V, Locking Receptacle:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
b. Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour; Legrand North America, LLC.

2. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN RTRT and UL 498.

4. Options:

a. Device Color: Black with yellow voltage indication on face.
b. Configuration: 2 pole, 3 wire, grounding, **NEMA L5-20R**.

2.5 CONNECTORS, CORDS, AND PLUGS

A. Outdoor-Use, Watertight, Sealed Cord Connector:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Ericson Manufacturing Company.

2. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

3. General Characteristics:

a. Reference Standards: UL CCN AXUT and UL 498.

4. Options:

a. Configuration:
1) NEMA 5-20 **with diagnostic LED indicator**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receptacles:

1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

B. Cord Reels:

1. Examine roughing-in for cord reel mounting and power connections to verify actual locations of mounts and power connections before cord reel installation.
2. Examine walls, floors, and ceilings for suitable conditions where cord reel will be installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GFCI RECEPTACLES

A. Healthcare Facilities: Unless protection of downstream branch-circuit wiring, cord sets, and power-supply cords is required by NFPA 70 or NFPA 99, provide non-feed-through GFCI receptacles.

3.3 INSTALLATION OF SWITCHES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

    a. Mark cover or cover plate using hot, stamped, or engraved machine printing with **black**-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.4 INSTALLATION OF STRAIGHT-BLADE RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

    a. Mark cover or cover plate using hot, stamped, or engraved machine printing with **black**-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.5 INSTALLATION OF LOCKING RECEPTACLES

A. Comply with manufacturer's instructions.

B. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.
2. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.
3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6.
4. Consult Architect for resolution of conflicting requirements.

C. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553 "Identification for Electrical Systems."

    a. Mark cover or cover plate using hot, stamped, or engraved machine printing with **black**-filled lettering, and provide durable wire markers or tags inside device box or outlet box.

3.6 INSTALLATION OF CONNECTORS, CORDS, AND PLUGS

A. Comply with manufacturer's instructions.

3.7 FIELD QUALITY CONTROL OF SWITCHES

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Perform tests and inspections in accordance with manufacturers' instructions.

C. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Assemble and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.8 FIELD QUALITY CONTROL OF STRAIGHT-BLADE RECEPTACLES

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.

C. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Assemble and submit test and inspection reports.

Retain "Manufacturer Services" Paragraph below if manufacturer's representative is required to support or supervise the administrant specified in Section 260010 "Supplemental Requirements for Electrical" for field tests and inspections performed by Installer or third-party agencies.

E. Manufacturer Services:

Retain "supervise" option in subparagraph below when third-party tests and inspections must be witnessed and approved by factory-authorized service representative to satisfy special extended warranty

requirements. In some cases, Installer may be factory authorized under warranty provisions to fulfill this role.

1. Engage factory-authorized service representative to [**support**] [**supervise**] field tests and inspections.

3.9 FIELD QUALITY CONTROL OF LOCKING RECEPTACLES

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.
2. Verify polarity of hot and neutral pins.
3. Measure line voltage.
4. Measure percent voltage drop.
5. Measure grounding circuit continuity; impedance must be not greater than 2 ohms.
6. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.

C. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Assemble and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.10 FIELD QUALITY CONTROL OF CONNECTORS, CORDS, AND PLUGS

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**] <**Insert names or titles of witnesses**.

B. Tests and Inspections:

1. Perform tests and inspections indicated in manufacturer's instructions.

C. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Assemble and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.11 SYSTEM STARTUP FOR SWITCHES

A. **Perform** startup service.

1. Complete installation and startup checks for momentary switches, dimmer switches, and fan-speed controller switches in accordance with manufacturer's instructions.

3.12 ADJUSTING

A. Occupancy Adjustments for Controlled Receptacles: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.

B. Cord Reels and Fittings: Adjust spring mechanisms and moving parts of cord reels and fittings to function smoothly, and lubricate as recommended in writing by manufacturer.

3.13 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.
2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

B. Connectors, Cords, and Plugs:

1. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 262726

SECTION 262813

FUSES

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Control circuits.
b. Panelboards.
c. Switchboards.
d. Enclosed controllers.
e. Enclosed switches.

2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit **in electronic format suitable for use in coordination software and in PDF format**.
5. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to **10** percent of quantity installed for each size and type, but no fewer than **three** of each size and type.

1.5 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than **40 deg F (5 deg C)** or more than **100 deg F (38 deg C)**, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: [**250**] [**600**]-V, zero- to 600-A rating, 200 kAIC[**, time delay**].
2. Type RK-5: [**250**] [**600**]-V, zero- to 600-A rating, 200 kAIC[**, time delay**].
3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC[**, fast acting**] [**, time delay**].
4. Type CD: 600-V, 31- to 60-A rating, 200 kAIC[**, fast acting**] [**, time delay**].
5. Type J: 600-V, zero- to 600-A rating, 200 kAIC[**, time delay**].
6. Type L: 600-V, 601- to 6000-A rating, 200 kAIC[**, time delay**].
7. Type T: [**250-V, zero- to 1200-A**] [**600-V, zero- to 800-A**] rating, 200 kAIC[**, very fast acting**] [**, time delay**].

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with [**15**] <**Insert number**> percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: [**Class L, fast acting**] [**Class L, time delay**] [**Class RK1, fast acting**] [**Class RK1, time delay**] [**Class J, fast acting**] [**Class J, time delay**] [**Class T, fast acting**].
2. Feeders: [**Class L, fast acting**] [**Class L, time delay**] [**Class RK1, fast acting**] [**Class RK1, time delay**] [**Class RK5, fast acting**] [**Class RK5, time delay**] [**Class J, fast acting**] [**Class J, time delay**].
3. Motor Branch Circuits: [**Class RK1**] [**Class RK5**] [**Class CC, motor duty**], time delay.
4. Large Motor Branch (601-4000 A): Class L, time delay.
5. Power Electronics Circuits: [**Class J, high speed**] [**Class T, fast acting**].
6. Other Branch Circuits: [**Class RK1, time delay**] [**Class RK5, time delay**] [**Class J, fast acting**] [**Class J, time delay**] [**Class CC, fast acting**].
7. Control Transformer Circuits: Class CC, time delay, control transformer duty.
8. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by **Construction Manager**.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

~~TIPS:~~

~~To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.~~

~~To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.~~

~~Content Requests:~~

~~<Double click here to submit questions, comments, or suggested edits to this Section.>~~

~~Revise this Section by deleting and inserting text to meet Project-specific requirements.~~

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. ~~Receptacle switches.~~
4. ~~Shunt trip switches.~~
5. ~~5.~~3. Molded-case circuit breakers (MCCBs).
6. ~~6.~~4. Molded-case switches.
7. ~~7.~~5. Enclosures.

B. Related Requirements:

~~Always retain two subparagraphs below.~~

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

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1.2 DEFINITIONS

~~Retain definition(s) remaining after this Section has been edited.~~

A. GFEP: Ground-fault circuit-interrupter for equipment protection.

B. GFLS: Ground-fault circuit-interrupter for life safety.

C. SPDT: Single pole, double throw.

1.3 ACTION SUBMITTALS

~~Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.~~

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).

~~Retain first subparagraph below if using series rating of overcurrent protective devices.~~

5. Include evidence of qualified electrical testing laboratory listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

~~Retain subparagraph below if final system short-circuit and coordination studies will be performed by the designer or will be assigned to an independent consultant. These curves are also beneficial to Owner for future additions or reevaluations of settings of overcurrent protective devices. Curves can normally be downloaded from manufacturers' websites or be obtained, in electronic form, from various coordination software vendors as part of a subscription service~~

7. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in ~~[~~**PDF**~~]~~ ~~[~~**and**~~]~~ ~~**<Insert calculation program format>**~~** electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

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1.4 INFORMATIONAL SUBMITTALS

A. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

~~See Section 017700 "Closeout Procedures" for submission of maintenance material items.~~

~~Retain "Spare Parts" Paragraph below if requested by Owner and spare parts are required for maintenance. Spare parts are components that occasionally fail and may be needed to repair products; for example: circuit breakers and fuses.~~

A. Spare Parts: Furnish to Owner spare parts, for repairing enclosed switches and circuit breakers, that are packaged with protective covering for storage on-site and identified with labels describing contents.~~[~~ **Include the following:**~~]~~

~~Coordinate first subparagraph below with Section 262813 "Fuses" for quantities of spare fuses and spare-fuse cabinet to be provided.~~

1. Fuses: Equal to ~~[~~**10**~~]~~ ~~<**Insert number**>~~ percent of quantity installed for each size and type, but no fewer than ~~[~~**three**~~]~~ ~~<**Insert number**>~~ of each size and type.
~~2.~~ Fuse Pullers: ~~[~~**Two**~~]~~ ~~<**Insert number**>~~ for each size and type.
~~3.~~2. ~~<**Insert spare parts**>.~~

1.7 WARRANTY

~~When warranties are required and available, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner, after one-year correction period specified in the Contract, under Contractor's general warranty and prevailing local laws.~~

~~Verify durations of extended-warranty periods needed.~~

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: ~~[~~**Two**~~]~~ ~~<**Insert number**>~~ years from date of Substantial Completion; full coverage for labor, materials, and equipment.

~~Retain "Special Manufacturer Extended Warranty" Paragraph below if Project requires that a special manufacturer extended warranty take over when the special Installer extended warranty expires. To benefit Owner, manufacturer extended-warranty period must be longer than Installer extended-warranty period.~~

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B. Special Manufacturer Extended Warranty: Manufacturer warrants that enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to provide repair or replacement of components or products that fail to perform as specified within extended-warranty period.

1. Extended Warranty Period: [**Three**] <**Insert number**> years from date of Substantial Completion; [**full**] [**prorated**] coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

Manufacturers and products listed in this Section are neither recommended nor endorsed by the AIA or Deltek. Before selecting manufacturers and products, verify availability, suitability for intended applications, and compliance with minimum performance requirements. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

Product options commonly available from manufacturers are included in square brackets throughout the Section Text. Not every manufacturer listed can provide every option offered; verify availability with manufacturers. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain products from single manufacturer.

Retain first paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Coordinate with Section 016000 "Product Requirements."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Some listed manufacturers offer the six-pole switch in amperage ratings higher than 1200 A. Copy article as required to include the types of fusible switches in Project.

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B. Type HD, Heavy Duty:

1. ~~[**Single**] [~~**Double**~~]~~ throw.
2. ~~[~~**Three**~~] [**six**]~~ pole.
3. ~~[~~**240**~~]~~ or ~~[~~**600**~~]~~ V(ac) per drawings.
4. ~~[**1200 A and smaller**] [**200 A and smaller**].~~
5. 4. UL 98 and NMA KS 1, horsepower rated, with clips or bolt pads to accommodate ~~[~~**specified**~~]~~ ~~[**indicated**]~~ fuses.
6. 5. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

~~Retain subparagraphs below with applicable switch paragraphs retained in this article. Certain combination of accessories may not be available; verify that accessories specified are available and applicable to switch types and ratings in this article. Indicate accessories for switches and circuit breakers on Drawings.~~

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.
6. Hookstick Handle: Allows use of hookstick to operate handle.

~~See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.~~

7. Auxiliary Contact Kit: ~~[~~**One**~~] [~~**Two**~~]~~ NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**6 V(dc)**] [**12 V(dc)**] [**24 V(dc)**].

~~See "Lugs" Article in the Evaluations for guidance on using mechanical versus compression lugs. Some size lugs (and lugs in other than UL 50E, Type 1 and UL 50E, Type 3R enclosures) are frequently available only for copper conductors; coordinate with manufacturers' literature.~~

8. Lugs: [**Mechanical**] [**Compression**] type, suitable for number, size, and conductor material.

2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

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A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Show pole quantities and voltage and ampere ratings of switches on Drawings. In first two paragraphs below, Type GD is for switches for light-commercial applications, 240 V(ac), 30 to 600 A; Type HD is for all other single-throw switch uses. See "Enclosed Switches" Article in the Evaluations.

B. Type GD, General Duty, Three Pole, Single Throw, 240 V(ac), 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C.B. Type HD, Heavy Duty, Three Pole, Single Throw, [**240**] or [**600**] V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

Some listed manufacturers offer the six-pole switch in amperage ratings higher than those in first paragraph below.

D. Type HD, Heavy Duty, Six Pole, Single Throw, [**240**] [**600**] V(ac), 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Three Pole, Double Throw, [**240**] [**600**] V(ac), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F.C. Accessories:

Retain subparagraphs below with applicable switch paragraphs retained in this article. Certain combination of accessories may not be available; verify that accessories specified are available and applicable to switch types and ratings in this article. Indicate accessories for switches and circuit breakers on Drawings.

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.
6. Hookstick Handle: Allows use of hookstick to operate handle.

See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.

7. Auxiliary Contact Kit: [**One**] [**Two**] NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**6 V(dc)**] [**12 V(dc)**] [**24 V(dc)**].

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~~See "Lugs" Article in the Evaluations for guidance on using mechanical versus compression lugs. Some size lugs (and lugs in other than UL 50E, Type 1 and UL 50E, Type 3R enclosures) are frequently available only for copper conductors; coordinate with manufacturers' literature.~~

8. Lugs: ~~[~~**Mechanical**~~]~~ ~~[**Compression**]~~ type, suitable for number, size, and conductor material.

~~2.4 RECEPTACLE SWITCHES~~

~~A. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

~~Listed manufacturers offer similar but different options for voltage and ampere ratings and the make and model of receptacles available for factory installation on their switches. See the "Receptacle Switches" Article in the Evaluations. Not all listed voltage and ampere ratings and enclosure types listed in "Enclosures" Article are available from all listed manufacturers.~~

~~Show pole quantities and voltage and ampere ratings of switches on Drawings. Retain one of last two options in first paragraph below depending on whether fuse applications and class designations are indicated on Drawings or specified in Section 262813 "Fuses." Show fuse ampere ratings on Drawings.~~

~~B. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: [**240**] [**600**] V(ac), [**30**] [**60**] [**100**] <**Insert number**> A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate [**specified**] [**indicated**] fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.~~

~~C. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: [**240**] [**600**] V(ac), [**30**] [**60**] [**100**] <**Insert number**> A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.~~

~~D. Interlocking Linkage: Provided between receptacle and switch mechanism to prevent inserting or removing plug while switch is in on position, inserting plug other than specified, and turning switch on if incorrect plug is inserted or correct plug has not been fully inserted into receptacle.~~

~~E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).~~

~~F. Accessories:~~

~~Retain subparagraphs below with applicable switch paragraphs retained in this article. Certain combination of accessories may not be available; verify that accessories specified are available and applicable to switch types and ratings in this article. Indicate accessories for switches and circuit breakers on Drawings.~~

~~1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.~~
~~2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.~~
~~3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.~~
~~4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.~~
~~5. Service-Rated Switches: Labeled for use as service equipment.~~

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6. Hookstick Handle: Allows use of hookstick to operate handle.

See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.

7. Auxiliary Contact Kit: [**One**] [**Two**] NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**6 V(dc)**] [**12 V(dc)**] [**24 V(dc)**].

See "Lugs" Article in the Evaluations for guidance on using mechanical versus compression lugs. Some size lugs (and lugs in other than UL 50E, Type 1 and UL 50E, Type 3R enclosures) are frequently available only for copper conductors; coordinate with manufacturers' literature.

8. Lugs: [**Mechanical**] [**Compression**] type, suitable for number, size, and conductor material.

2.5 SHUNT TRIP SWITCHES

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

Show voltage and ampere ratings of shunt trip switches and fuses on Drawings. See "Shunt Trip Switches" Article in the Evaluations for guidance on using shunt trip switches.

Retain option in first paragraph below if shunt trip switches are used as elevator shunt trip disconnects per ASME A17.1 and NFPA 70. Coordinate with Section 142100 "Electric Traction Elevators," Section 142113 "Electric Traction Freight Elevators," Section 142400 "Hydraulic Elevators," Section 142413 "Hydraulic Freight Elevators," Section 142600 "Limited-Use/Limited-Application Elevators," Section 143100 "Escalators," Section 143200 "Moving Walks," and Section 144200 "Wheelchair Lifts."

B. General Requirements: Comply with[**ASME A17.1,**] UL 50, and UL 98, with Class J fuse block and 200 kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: [**240**] [**600**] V(ac), [**30**] [**60**] [**100**] <**Insert number**> A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate [**specified**] [**indicated**] fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Type HD, Heavy-Duty, Three Pole, Single-Throw Nonfusible Switch: [**240**] [**600**] V(ac), [**30**] [**60**] [**100**] <**Insert number**> A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

E. Control Circuit: 120 V(ac); obtained from [**integral control power transformer, with primary and secondary fuses,**] <**Insert source of control power**> with control power [**transformer**] [**source**] of enough capacity to operate shunt trip, pilot, indicating and control devices.

F. Accessories:

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~~Not all accessories listed in subparagraphs below are available from every listed manufacturer. Verify availability and unique characteristics with manufacturers selected. Indicate accessories for switches and circuit breakers on Drawings.~~

~~1. Oiltight key switch for key-to-test function.~~
~~2. Oiltight [**red**] [**green**] [**white**] [**yellow**] ON pilot light.~~
~~3. Isolated neutral lug; [**100**] [**200**] percent rating.~~

~~Retain first subparagraph below if using switch for hydraulic elevators with automatic recall. Show required interface wiring on Drawings.~~

~~4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.~~

~~Retain first two subparagraphs below when interfacing elevators with the facility fire-alarm system is required. In first subparagraph, if retaining 24 V(dc) coil option, a separate 24 V(dc) source and an initiating contact must be provided by the facility fire-alarm system.~~

~~5. Three-pole, double-throw, fire-safety and alarm relay; [**120 V(ac)**] [**24 V(dc)**] coil voltage.~~
~~6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.~~
~~7. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.~~
~~8. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.~~
~~9. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.~~
~~10. Service-Rated Switches: Labeled for use as service equipment.~~
~~11. Hookstick Handle: Allows use of hookstick to operate handle.~~
~~12. Form C alarm contacts that change state when switch is tripped.~~

~~See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. Integrally mounted control power is not available in safety switches.~~

~~13. Auxiliary Contact Kit: [**One**] [**Two**] NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**6 V(dc)**] [**12 V(dc)**] [**24 V(dc)**].~~

~~See "Lugs" Article in the Evaluations for guidance on using mechanical versus compression lugs. Some size lugs (and lugs in other than UL 50E, Type 1 and UL 50E, Type 3R enclosures) are frequently available only for copper conductors; coordinate with manufacturers' literature.~~

~~14. Lugs: [**Mechanical**] [**Compression**] type, suitable for number, size, and conductor material.~~

~~2.6~~2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

~~A. <Double click here to find, evaluate, and insert list of manufacturers and products.>~~

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~~Show pole quantities, voltage and ampere ratings, and features and accessories of MCCBs and switches on Drawings. See the Evaluations.~~

B. Circuit breakers must be constructed using glass-reinforced insulating material. Current carrying components must be completely isolated from handle and accessory mounting area.

C. Circuit breakers must have toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. Circuit-breaker handle must be over center, be trip free, and reside in tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon must be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit-breaker tripping mechanism for maintenance and testing purposes.

~~If series rated breakers are not allowed, delete the references to series rated in first paragraph below.~~

D. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings must be clearly marked on face of circuit breaker. Circuit breakers must be ~~[100 percent rated] [series rated]~~ [**100 percent rated or series rated as indicated on Drawings**]. ~~[~~**Circuit breaker/circuit breaker**~~] [Fuse/circuit breaker]~~ combinations for series connected interrupting ratings must be listed by UL as recognized component combinations. Series rated combination used must be marked on end-use equipment along with statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

E. MCCBs must be equipped with device for locking in isolated position.

F. Lugs must be suitable for ~~[60 deg C rated wire on 125 A circuit breakers and below] [~~**75 deg C rated wire**~~] [90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70]~~.

G. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, RMS sensing, with the following field-adjustable settings:

~~Retain one or more of four subparagraphs below and coordinate required adjustable settings with Section 260573.16 "Coordination Studies." Indicate requirements for each switch and circuit breaker on Drawings.~~

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1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

~~Retain first paragraph below for GFLS circuit breakers for personnel ground-fault protection as required by NFPA 70; retain second paragraph for equipment ground-fault protection (e.g., for self-limiting heat trace cables) as required by NFPA 70. GFLS and GFEP circuit breakers are only available fully rated up to interrupting ratings of 22 kA.~~

M. GFLS Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6 mA trip).

N. GFEP Circuit Breakers: With Class B ground-fault protection (30 mA trip).

O. Features and Accessories:

~~Not all features, accessories, and options in subparagraphs below are available for every rating and from every listed manufacturer. Verify availability and unique characteristics with manufacturers selected.~~

1. Standard frame sizes, trip ratings, and number of poles.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
4. Alarm Switch: One [**NO**] [**NC**] contact that operates only when circuit breaker has tripped.
5. Auxiliary Contacts: [**One SPDT switch**] [**Two SPDT switches**] with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

~~See the Evaluations for guidance on using mechanical versus compression lugs.~~

6. Lugs: ~~[~~**Mechanical**~~]~~ ~~[~~**Compression**~~]~~ type, suitable for number, size, trip ratings, and conductor material.

~~Retain first option in first subparagraph below for solid-state trip units; retain second option for thermal-magnetic trip units.~~

7. Ground-Fault Protection: Comply with UL 1053; [**integrally mounted, self-powered**] [**remote-mounted and powered**] type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
8. Communication Capability: [**Circuit-breaker-mounted**] [**Universal-mounted**] [**Integral**] [**Din-rail-mounted**] communication module with functions and features

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compatible with power monitoring and control system, specified in Section 260913 "Electrical Power Monitoring and Control."

An optional time-delay unit, which allows an adjustable time delay in release of the trip coil for overriding momentary fluctuations, is available for the undervoltage trip unit in first subparagraph below.

9. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key must be removable only when circuit breaker is in off position.

Retain first option in first subparagraph below for solid-state trip units; retain second option for thermal-magnetic trip units.

11. Zone-Selective Interlocking: Integral with [**electronic**] [**ground-fault**] trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.

Retain subparagraph below if retaining options requiring integral or remote-control power in subparagraphs above and if control power for remote indication or operation is not specified in other Sections. See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. First option below may not be available in all voltages; coordinate with manufacturers' literature.

13. Accessory Control Power: [**Integrally mounted, self-powered**] [**Remote mounted and powered**]; [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**12 V(dc)**] [**24 V(dc)**] [**120 V(dc)**].

2.7 MOLDED-CASE SWITCHES

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

D. Features and Accessories:

Not all features, accessories, and options listed in subparagraphs below are available for every rating and from every listed manufacturer. Verify availability and unique characteristics with manufacturers selected.

1. Standard frame sizes and number of poles.

See the Evaluations for guidance on using mechanical versus compression lugs.

2. Lugs:

a. [**Mechanical**] [**Compression**] type, suitable for number, size, trip ratings, and conductor material.

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b. Lugs must be suitable for [**60 deg C rated wire on 125 A circuit breakers and below**] [**75 deg C rated wire**] [**90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70**].

3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

An optional time-delay unit, which allows an adjustable time delay in release of the trip coil for overriding momentary fluctuations, is available for the undervoltage trip unit in first subparagraph below.

5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: [**One SPDT switch**] [**Two SPDT switches**] with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One [**NO**] [**NC**] contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key must be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.

Retain subparagraph below if retaining options requiring integral or remote-control power in subparagraphs above and if control power for remote indication or operation is not specified in other Sections. See "Control Power Options" Article in the Evaluations for various sources available for control power. Although other voltages are available, the Section Text includes only those that are most frequently encountered and listed in manufacturers' literature. First option below may not be available in all voltages; coordinate with manufacturers' literature.

11. Accessory Control Power Voltage: [**Integrally mounted, self-powered**] [**Remote mounted and powered**]; [**24 V(ac)**] [**120 V(ac)**] [**208 V(ac)**] [**240 V(ac)**] [**12 V(dc)**] [**24 V(dc)**] [**120 V(dc)**].

2.82.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: Enclosure must be [**finished with**] [**gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (UL 50E Type 1)**] [**gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (UL 50E Types 3R, 12)**] [**a brush finish on Type 304 stainless steel (UL 50E Type 4-4X stainless steel)**] [**copper-free cast aluminum alloy (UL 50E Types 7, 9)**].

C. Conduit Entry: UL 50E Types 4, 4X, and 12 enclosures may not contain knockouts. UL 50E Types 7 and 9 enclosures must be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: Circuit-breaker operating handle must be [**externally operable with operating mechanism being integral part of box, not cover**] [**directly operable through**

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~~front cover of enclosure (UL 50E Type 1)~~] [~~directly operable through dead front trim of enclosure (UL 50E Type 3R)~~] [~~externally operable with operating mechanism being integral part of cover (UL 50E Types 7, 9)~~]. Cover interlock mechanism must have externally operated override. Override may not permanently disable interlock mechanism, which must return to locked position once override is released. Tool used to override cover interlock mechanism must not be required to enter enclosure in order to override interlock.

E. Enclosures designated as UL 50E Type 4, 4X stainless steel, 12, or 12K must have dual cover interlock mechanism to prevent unintentional opening of enclosure cover when circuit breaker is ON and to prevent turning circuit breaker ON when enclosure cover is open.

F. UL 50E Type 7/9 enclosures must be furnished with breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.2 SELECTION OF ENCLOSURES

~~See "Enclosures" Article in the Evaluations for discussion of enclosure types. Coordinate subparagraphs below with Drawings by identifying the designated areas on plans or by including the required enclosure types. Availability of some enclosure types is limited by type of switch or circuit breaker; consult manufacturers for availability of, and limitations on, other than UL 50E, Type 1 enclosures. General-duty switches are generally only available in UL 50E, Type 1 or UL 50E, Type 3R enclosures.~~

A. Indoor, Dry and Clean Locations: UL 50E, ~~[~~**Type 1.**~~] <Insert type>.~~

B. Outdoor Locations: UL 50E, ~~[~~**Type 3R**~~] [Type 4X] <Insert type>.~~.

C. ~~[~~**Kitchen**,~~]~~ ~~[~~**Wash-Down**~~]~~ Areas: UL 50E, ~~[~~**Type 4X.**~~] <Insert type>, [stainless steel] <Insert material>.~~

~~D. Other Wet or Damp, Indoor Locations: UL 50E, [Type 4] <Insert type>.~~

~~E. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, Type 12.~~

~~Retain one of first two options in subparagraph below to comply with the division and group listing of the environment. Frequently, one enclosure type will accommodate more than one hazardous environment~~

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~~rating. Consult manufacturers for availability of, and limitations on, hazardous environment enclosures. These enclosures do not apply to shunt trip or receptacle switches as specified in the Section Text.~~

~~F. Hazardous Areas Indicated on Drawings: UL 50E, [**Type 7**] [**Type 9**] <**Insert type**> [**with cover attached by Type 316 stainless steel bolts**].~~

3.3 INSTALLATION

A. Comply with manufacturer's published instructions.

~~NFPA 70 and NECA NEIS 1 are already specified in Section 260010 "Supplemental Requirements for Electrical."~~

B. Special Techniques:

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

~~Indicate locations of switches and circuit breakers 1200 A and larger, showing increased working clearances and NFPA 70 required egress devices and clearances.~~

2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

~~Retain first paragraph below if seismic controls are required for Project. Coordinate with Drawings.~~

~~3. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."~~

~~4.~~3. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

~~5.~~4. Install fuses in fusible devices.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.5 FIELD QUALITY CONTROL

~~A. [**Acceptance**]Testing Preparation:~~

~~1. <**Insert requirements**>.~~

~~Retain first paragraph below to require that field quality-control tests be witnessed. Local ordinance or custom may require that authorities having jurisdiction witness the testing.~~

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~~B.~~A. Field tests and inspections must be witnessed by ~~[Architect] [Tenant] [~~**authorities having jurisdiction**~~] <Insert names or titles of witnesses>~~.

~~Coordinate "Tests and Inspections" Paragraph below with "Qualifications" and "Field Quality Control" articles in Section 260010 "Supplemental Requirements for Electrical."~~

~~Retain one or both of "Tests and Inspections for Switches" or "Tests and Inspections for Molded-Case Circuit Breakers" Paragraph below. If both types of equipment are included in Project, retain both paragraphs.~~

~~Tests below are specific to switches and are derived from NETA ATS. Retain tests applicable to this installation. For new equipment, it may not be necessary to duplicate work at the factory.~~

~~C.~~B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

   a. Inspect physical and mechanical condition.
   b. Inspect anchorage, alignment, grounding, and clearances.
   c. Verify that unit is clean.
   d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
   e. Verify that fuse sizes and types match the Specifications and Drawings.
   f. Verify that each fuse has adequate mechanical support and contact integrity.
   g. Inspect bolted electrical connections for high resistance using one of the following methods:

      1) Use low-resistance ohmmeter.

         a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

         a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

   h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.
   i. Verify correct phase barrier installation.
   j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

~~Resistance measurement tests are not included under "Electrical Tests" Subparagraph below because they are included under "Visual and Mechanical Inspection" Subparagraph above.~~

2. Electrical Tests:

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a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test in accordance with NETA ATS Section 7.14 "Ground Fault Protection Systems, Low-Voltage."

~~Tests below are specific to MCCBs and are derived from the NETA ATS. Retain tests applicable to this installation. For new equipment, it may not be necessary to duplicate work at the factory.~~

~~D.~~C. Tests and Inspections for Molded-Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that unit is clean.
e. Operate circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

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~~Retain subparagraph below only if Section 260573.16 "Coordination Studies" is included in Project.~~

h. Perform adjustments for final protective device settings in accordance with coordination study.

~~Resistance measurement tests are not included under "Electrical Tests" Subparagraph below because they are included under "Visual and Mechanical Inspection" Subparagraph above.~~

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, use Table 100.1 from NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
c. Perform contact/pole resistance test. Drop values may not exceed high level of manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
d. Perform insulation resistance tests on control wiring with respect to ground. Applied potential must be 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable. Test duration must be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values may be no less than 2 M Ω.
e. Determine the following by primary current injection:

1) Long-time pickup and delay. Pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
2) Short-time pickup and delay. Short-time pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
3) Ground-fault pickup and time delay. Ground-fault pickup values must be as specified. Trip characteristics may not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
4) Instantaneous pickup. Instantaneous pickup values must be as specified and within manufacturer's published tolerances.

~~NETA ATS indicates that the test below is an optional test.~~

f. Test functionality of trip unit by means of primary current injection. Pickup values and trip characteristics must be as specified and within manufacturer's published tolerances.
g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must be as indicated by manufacturer.

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h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset trip logs and indicators. Investigate units that do not function as designed.

i. Verify operation of charging mechanism. Investigate units that do not function as designed.

3. Test and adjust controls, remote monitoring, and safeties.

~~See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.~~

~~E.~~D. Nonconforming Work:

1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
2. Remove and replace defective units and retest.

~~F.~~E. Collect, assemble, and submit test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

~~Retain "Manufacturer Services" Paragraph below if manufacturer's representative is required to support or supervise the administrant specified in Section 260010 "Supplemental Requirements for Electrical" for field tests and inspections performed by Installer or third-party agencies.~~

~~G.~~F. Manufacturer Services:

~~Retain "supervise" option in subparagraph below when third-party tests and inspections must be witnessed and approved by factory-authorized service representative to satisfy special extended-warranty requirements. In some cases, Installer may be factory authorized under warranty provisions to fulfill this role.~~

1. Engage factory-authorized service representative to ~~[~~**support**~~]~~ ~~[~~**supervise**~~]~~ field tests and inspections.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

~~Retain first option in paragraph below if the indicated Section is included in the Contract Documents. Retain second option and include settings on Drawings or in a schedule attached to this Section if indicated Section is not included in the Contract Documents.~~

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B. Set field-adjustable circuit-breaker trip ranges~~[~~ **as specified in Section 260573.16 "Coordination Studies."**~~]~~ ~~[to values indicated on Drawings.]~~ ~~[to values indicated in attached schedule.]~~

3.7 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

A. Infrared Scanning of Enclosed Switches and Breakers: Two months after Substantial Completion, perform infrared scan of joints and connections. Remove covers so joints and connections are accessible to portable scanner. Take visible light photographs at same locations and orientations as infrared scans for documentation to ensure follow-on scans match same conditions for valid comparison.

1. Instruments and Equipment: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Follow-up Infrared Scanning: Perform two follow-up infrared scans of enclosed switches and breakers, one at four months and another at 11 months after Substantial Completion.
3. Instrument: Use infrared-scanning device designed to measure temperature or to detect significant deviations from normal values. Provide documentation of device calibration.
4. Report: Prepare certified report that identifies units checked and that describes scanning results. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 262816

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SECTION 262913.03

MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Combination full-voltage magnetic motor controllers.
4. Enclosed reduced-voltage magnetic motor controllers.
5. Combination reduced-voltage magnetic motor controllers.
6. Multispeed magnetic motor controllers.
7. Combination multispeed magnetic motor controllers.
8. Enclosures.
9. Accessories.
10. Identification.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. NC: Normally closed.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

    a. Listing document proving Type 2 coordination.

7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Routine maintenance requirements for magnetic controllers and installed components.
    b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
    c. Manufacturer's written instructions for setting field-adjustable overload relays.
    d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to **10** percent of quantity installed for each size and type, but no fewer than t**hree** of each size and type.
2. Control Power Fuses: Equal to **10** percent of quantity installed for each size and type, but no fewer than **two** of each size and type.
3. Indicating Lights: **Two** of each type and color installed.
4. Auxiliary Contacts: Furnish **one** spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish **three** spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; **connect factory-installed space heaters to temporary electrical service**.

1.10 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than23 deg F (minus 5 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m) for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

1. The term "withstand" means "the controller will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

2.2 MANUAL MOTOR CONTROLLERS

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Motion Business.
b. Eaton.
c. Rockwell Automation, Inc.
d. Siemens Industry, Inc., Energy Management Division.
e. Square D; Schneider Electric USA.

2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
3. Configuration: **Nonreversing**, **Reversing**, **Two speed** as required.
4. **Surface** mounting.
5. **Red** pilot light.
6. Additional Nameplates: **FORWARD and REVERSE for reversing switches**.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. ABB, Motion Business.
c. Eaton.
d. Rockwell Automation, Inc.
e. Siemens Industry, Inc., Energy Management Division.
f. Square D; Schneider Electric USA.

2. Configuration: **Nonreversing**.

Retain one of two "Overload Relays" subparagraphs below. See "Motor Overload Protection" Article in the Evaluations for additional guidance on retaining options in first subparagraph below. Although Class 10 seems to be "standard" for this equipment, some manufacturers may offer others. Retain first option below unless another class is required and available.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, **Class 10** tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button**; bimetallic type**.
4. Overload Relays: NEMA ICS 2, bimetallic class as schedule on Drawings.
5. Pilot Light: **Red**.

C. Integral Horsepower Manual Controllers (IHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ABB, Electrification Business.
b. ABB, Motion Business.
c. Eaton.
d. Rockwell Automation, Inc.
e. Siemens Industry, Inc., Energy Management Division.
f. Square D; Schneider Electric USA.

2. Configuration: **Nonreversing**.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, **Class 10** tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button**; bimetallic type**.
4. Overload Relays: NEMA ICS 2, bimetallic class as scheduled on Drawings.

2.3 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ABB, Motion Business.
3. Eaton.
4. Rockwell Automation, Inc.
5. Siemens Industry, Inc., Energy Management Division.
6. Square D; Schneider Electric USA.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: **Nonreversing**.

E. Contactor Coils: Pressure-encapsulated type **with coil transient suppressors when indicated**.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. Spare CPT Capacity as Indicated on Drawings: **100** VA.

G. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.
b. **Class 10** tripping characteristic.
c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
d. Ambient compensated.
e. Automatic resetting.

2. Solid-State Overload Relay:

a. Switch or dial selectable for motor-running overload protection.
b. Sensors in each phase.
c. **Class 10/20 selectable**] tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
d. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

H. Digital communication module, using **RS-485 Modbus, RTU protocol, 2** or **4-wire connection to host devices with a compatible port** to transmit the following to the LAN:

1. Instantaneous rms current each phase, and 3-phase average.
2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
3. Active Energy (kWh): 3-phase total.
4. Power Factor: **Each phase and** 3-phase total

2.4 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ABB, Motion Business.
3. Eaton.

4. Rockwell Automation, Inc.
5. Siemens Industry, Inc., Energy Management Division.
6. Square D; Schneider Electric USA.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: **Nonreversing**.

E. Contactor Coils: Pressure-encapsulated type **with coil transient suppressors when indicated**.

1. Operating Voltage: Manufacturer's standard, unless indicated.

F. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. Spare CPT Capacity as Indicated on Drawings: **100** VA.

G. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.
b. **Class 10** tripping characteristic.
c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
d. Ambient compensated.
e. Automatic resetting.

2. Solid-State Overload Relay:

a. Switch or dial selectable for motor-running overload protection.
b. Sensors in each phase.
c. **Class 10/20 selectable** tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

Retain first paragraph below for Class II ground-fault protection, and indicate where used in the schedule on Drawings.

H. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.

I. Digital communication module, using **RS-485 Modbus, RTU protocol,** [**2**] [**4**]**-wire connection to host devices with a compatible port** to transmit the following to the LAN:

1. Instantaneous rms current each phase, and 3-phase average.
2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
3. Active Energy (kWh): 3-phase total.
4. Power Factor: **Each phase and** 3-phase total.

J. Fusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

K. Nonfusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

L. MCP Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

M. MCCB Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse-time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.5 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.6 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.

   a. Push Buttons: As indicated in the controller schedule.
   b. Pilot Lights: As indicated in the controller schedule.

2. Elapsed Time Meters: Heavy duty with digital readout in hours **resettable**.
3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.

B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.

1. Phase-failure.
2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.
3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

C. Breather assemblies, to maintain interior pressure and release condensation in **Type 4** enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

D. Space heaters, with NC auxiliary contacts, to mitigate condensation in **Type 3R**] enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

E. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.7 IDENTIFICATION

A. Controller Nameplates: **Laminated acrylic or melamine plastic signs**, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

B. Arc-Flash Warning Labels:

1. Comply with requirements in Section 260573.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
2. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

    a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

        1) Location designation.
        2) Nominal voltage.
        3) Flash protection boundary.
        4) Hazard risk category.
        5) Incident energy.
        6) Working distance.
        7) Engineering report number, revision number, and issue date.

    b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Floor-Mounted Controllers: Install controllers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

D. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

G. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.

2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with drawings and specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
    e. Inspect contactors:

        1) Verify mechanical operation.
        2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

    f. Motor-Running Protection:

        1) Verify overload element rating is correct for its application.
        2) If motor-running protection is provided by fuses, verify correct fuse rating.

    g. Inspect bolted electrical connections for high resistance using one of the two following methods:

        1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

    h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

    a. **Perform** insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
    b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
    c. Test motor protection devices according to manufacturer's published data.
    d. Test circuit breakers as follows:

        1) Operate the circuit breaker to ensure smooth operation.
        2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.

    e. Perform operational tests by initiating control devices.

4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.

a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:

1) Description of equipment to be tested.
2) Discrepancies.
3) Temperature difference between the area of concern and the reference area.
4) Probable cause of temperature difference.
5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
6) Load conditions at time of inspection.
7) Photographs and thermograms of the deficient area.
8) Recommended action.

e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
f. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

E. Motor controller will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. **Train**]Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION 262913.03

SECTION 262913.06

SOFT-START MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes soft-start motor controllers that are designed for reduced-voltage start and full-voltage run duty.

1. Enclosed soft-start controllers.
2. Combination soft-start controllers.
3. Bypass motor controller.
4. Enclosures.
5. Accessories.
6. Identification.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. FLA: Full-load current.

C. MCCB: Molded-case circuit breaker.

D. MCP: Motor circuit protector.

E. NC: Normally closed.

F. NO: Normally open.

G. OCPD: Overcurrent protective device.

H. SCCR: Short-circuit current rating.

I. SCPD: Short-circuit protective device.

J. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual OCPD and auxiliary components.

C. Product Schedule: For each enclosed controller.

1. Each installed soft-start controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.

a. For each combination soft-start controller, include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

1) Listing document proving Type 2 coordination.

b. For each series-rated combination, state the listed integrated SCCR (withstand) of SCPDs and OCPDs by an NRTL acceptable to authorities having jurisdiction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Seismic Qualification Data: Certificates, for soft-start controllers, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Source quality-control reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For soft-start controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

    a. Routine maintenance requirements for soft-start controllers and installed components.
    b. Manufacturer's written instructions for testing and adjusting circuit-breaker and MCP trip settings.
    c. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage soft-start controllers.
    d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate FLAs.
    e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to **10** percent of quantity installed for each size and type, but no fewer than **three** of each size and type.
2. Control Power Fuses: Equal to **10** percent of quantity installed for each size and type, but no fewer than **two** of each size and type.
3. Indicating Lights: **Two** of each type and color installed.
4. Auxiliary Contacts: Furnish **one** spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish **three** spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store soft-start controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect soft-start controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover soft-start controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; **connect factory-installed space heaters to temporary electrical service**.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C), humidity noncondensing.
2. Altitude: Not exceeding 3300 feet (1000 m).

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLER PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label enclosed controllers to comply with UL 508.

C. NEMA Compliance: Fabricate motor controllers to comply with NEMA ICS 2.

D. Seismic Performance: Soft-start controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified **and the unit will be fully operational after the seismic event**."

2.2 ENCLOSED SOFT-START MOTOR CONTROLLERS

A. Description: Controllers designed for reduced-voltage start, full-voltage run, and optional soft stop. The controller shall be an integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and user interface module, run-bypass contactor, and overload relay(s); suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Run-Bypass Contactor: Magnetic contactor in parallel with the SCR of the soft-start controller, bypassing the SCR when full voltage is achieved.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ABB, Motion Business.
3. Eaton.
4. Rockwell Automation, Inc.
5. Siemens Industry, Inc., Energy Management Division.
6. Square D; Schneider Electric USA.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: **Standard duty**.

1. At least two SCRs per phase to control the starting and stopping of the motor.
2. Microprocessor control shall continuously monitor current and proper operation of the SCRs.
3. Bypass Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Soft-start controller protective features and deceleration controls shall remain active when this contactor is in the bypass mode.
4. Power Electronics Disconnect Contactor. Where indicated, installed ahead of the power electronics equipment, and shall open automatically when the motor is stopped, or a controller fault is detected, or when an SCR shorts.
5. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
6. Surge Protection: Comply with NEMA ICS 2 requirements for surge suppression.

E. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
2. Spare CPT Capacity: As indicated on Drawings, available in increments of 100 VA, from 100 to 500 VA.

F. Controller Diagnostics and Protection:

1. Microprocessor-based thermal-protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
2. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and under-load conditions; and line frequency over or under normal.
3. Input isolation contactor that opens when the controller diagnostics detect a faulted soft-start component or when the motor is stopped.

G. Cover mounted-controller status panel with LED lights or alphanumeric display to show the following:

1. Starter Status: "Ready," "starting," "stopping," or "run."
2. Motor current in amperes.
3. Faults:

    a. Motor overcurrent trip.
    b. Motor thermal overload.
    c. Starter thermal fault.
    d. Low line voltage.
    e. Loss of a phase.
    f. Phases reversed.
    g. Maximum stating time exceeded.
    h. Serial communications error.

H. Interface Panel: **Mounted on controller door With plug-in connector and removable.**

1. Guarded adjustable set points, not readily accessible.

    a. Motor FLA, adjustable from **40 to 110** percent of the controller's rating.
    b. Current limitation on starting, adjustable from 200 to 500 percent of FLA, typically set at 300 percent.

c. NEMA ICS 2 overload class. Selections shall include the following tripping classes: Class 5, Class 10, Class 15, Class 20, and Class 30.

2. Adjustable set points, readily accessible**, password protected**.

a. Linear acceleration, adjustable from **1 to 60 s**.
b. Maximum start time, adjustable from **1 to 250 s**.
c. Selector switch; select coast to stop or soft stop.
d. Linear deceleration, adjustable from **1 to 60 s**.

I. Remote Output Features. All outputs shall be prewired to terminal blocks.

1. Analog output for field-selectable assignment of motor operating characteristics; **0- to 10-V dc**.
2. Form C status contacts that change state when controller is running.
3. Form C alarm contacts that change state when a fault condition occurs.

J. Digital Communication Module: **RS-485 Modbus, RTU protocol,** [**2**] [**4**]**-wire connection to host devices with a compatible port** to transmit the following to the LAN:

1. Instantaneous root mean square (rms) current each phase, and three-phase average.
2. Voltage: L-L for each phase, L-L three-phase average, L-N each phase, and L-N three-phase average - rms.
3. Active Energy (kilowatt-hour): Three-phase total.
4. Power Factor: **Each phase and** three-phase total

2.3 COMBINATION SOFT-START MOTOR CONTROLLERS

A. Description: Factory-assembled, combination, reduced-voltage soft-start controller with a disconnecting means, SCPD and OCPD, in a single enclosure. The reduced-voltage soft-start controller shall consist of an integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and user interface module, run-bypass contactor, and overload relay(s); suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.

1. Run-Bypass Contactor: Magnetic contactor in parallel with the SCR of the soft-start controller, bypassing the SCR when full voltage is achieved.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ABB, Motion Business.
3. Eaton.
4. Rockwell Automation, Inc.
5. Siemens Industry, Inc., Energy Management Division.
6. Square D; Schneider Electric USA.

C. Standard: Comply with NEMA ICS 2, general purpose, Class A.

D. Configuration: **Standard duty**.

1. At least two SCRs per phase to control the starting and stopping of the motor.

2. Microprocessor control shall continuously monitor current and proper operation of the SCRs.
3. Bypass Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Soft-start controller protective features and deceleration controls shall remain active when this contactor is in the bypass mode.
4. Power Electronics Disconnect Contactor. Where indicated, installed ahead of the power electronics equipment, and shall open automatically when the motor is stopped, or a controller fault is detected, or when an SCR shorts.
5. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
6. Surge Protection: Comply with NEMA ICS 2 requirements for surge suppression.

E. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
2. Spare CPT Capacity: As indicated on Drawings, available in increments of 100 VA, from 100 to 500 VA.

F. Controller Diagnostics and Protection:

1. Microprocessor-based thermal-protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
2. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and under-load conditions; and line frequency over or under normal.
3. Input isolation contactor that opens when the controller diagnostics detect a faulted soft-start component or when the motor is stopped.

G. Cover mounted-controller status panel with LED lights or alphanumeric display to show the following:

1. Starter Status: "Ready," "starting," "stopping," or "run."
2. Motor current in amperes.
3. Faults:

    a. Motor overcurrent trip.
    b. Motor thermal overload.
    c. Starter thermal fault.
    d. Low line voltage.
    e. Loss of a phase.
    f. Phases reversed.
    g. Maximum stating time exceeded.
    h. Serial communications error.

H. Interface Panel: **Mounted on controller door With plug-in connector and removable.**

1. Guarded adjustable set points, not readily accessible.

    a. Motor FLA, adjustable from **40 to 110** percent of the controller's rating.
    b. Current limitation on starting, adjustable from 200 to 500 percent of FLA, typically set at 300 percent.

c. NEMA ICS 2 overload class. Selections shall include the following tripping classes: Class 5, Class 10, Class 15, Class 20, and Class 30.

2. Adjustable set points, readily accessible**, password protected**.

a. Linear acceleration, adjustable from **1 to 60 s**.
b. Maximum start time, adjustable from **1 to 250 s**.
c. Selector switch; select coast to stop or soft stop.
d. Linear deceleration, adjustable from **1 to 60 s**.

I. Remote Output Features: All outputs shall be prewired to terminal blocks.

1. Analog output for field-selectable assignment of motor operating characteristics; [**0- to 10-V dc**] [**4- to 20-mA dc**].
2. Form C status contacts that change state when controller is running.
3. Form C alarm contacts that change state when a fault condition occurs.

J. Digital Communication Module: **RS-485 Modbus, RTU protocol,** [**2**] [**4**]**-wire connection to host devices with a compatible port** to transmit the following to the LAN:

1. Instantaneous rms current each phase, and three-phase average.
2. Voltage: L-L for each phase, L-L three-phase average, L-N each phase, and L-N three-phase average - rms.
3. Active Energy (kilowatt-hour): Three-phase total.
4. Power Factor: **Each phase and** three-phase total.

K. Fusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate **indicated** fuses.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.

L. MCP Disconnecting Means:

1. UL 489 and NEMA AB 3 (with interrupting capacity to comply with available fault currents) instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
4. **NC** alarm contact that operates only when MCP has tripped.

a. Current-limiting module to increase controller SCCR (withstand) to 100 kA.

M. MCCB Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
4. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
5. **NC** alarm contact that operates only when MCCB has tripped.

N. Molded-Case Switch Disconnecting Means:

1. UL 489 and NEMA AB 3, with in-line fuse block for Class J or Class L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
3. Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.
4. **NC** alarm contact that operates only when molded-case switch has tripped.

2.4 ENCLOSURES

A. Comply with NEMA 250, Type designations as indicated on Drawings, to comply with environmental conditions at installed location.

B. Construction of the enclosures shall comply with NEMA ICS 6.

C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.5 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard duty, except as needed to match enclosure type. Heavy-duty or oiltight where indicated in the controller schedule.

   a. Push Buttons: As indicated in the controller schedule.
   b. Pilot Lights: As indicated in the controller schedule.

2. Elapsed Time Meters: Heavy duty with digital readout in hours**; resettable**.
3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide selector switches with an off position.

B. Space heaters, with NC auxiliary contacts, to mitigate condensation in **Type 3R** enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

2.6 IDENTIFICATION

A. Controller Nameplates: **Laminated acrylic or melamine plastic** signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

B. Arc-Flash Warning Labels:

1. Comply with requirements in Section 260573.19 "Arc-Flash Hazard Analysis." Produce a 3-1/2-by-5-inch (89-by-127-mm) self-adhesive label for each work location included in the analysis.
2. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3-1/2-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work

location included in the analysis. Labels shall be machine printed, with no field-applied markings.

a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1) Location designation.
2) Nominal voltage.
3) Flash protection boundary.
4) Hazard risk category.
5) Incident energy.
6) Working distance.
7) Engineering report number, revision number, and issue date.

b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Wall-Mounted Controllers: Install controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on slotted support systems complying with Section 260529 "Hangers and Supports for Electrical Systems," and bolted to wall.

C. Freestanding Controllers: Provide slotted support systems complying with Section 260529 "Hangers and Supports for Electrical Systems."

D. Floor-Mounted Controllers: Install controllers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

E. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."

F. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

G. Control Wiring: Separate control wiring from power wiring. Where unavoidable, use twisted pair cabling or shielded cables for control wiring.

H. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

I. Setting of Overload Relays: Select and set overloads on the basis of FLA rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for high-torque, high-efficiency, and so on motors.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections **with the assistance of a factory-authorized service representative**.

Retain test requirements below with any combination of paragraphs above. The following tests and inspections are derived from the NETA ATS.

D. Tests and Inspections:

1. Comply with provisions of NFPA 70B, Chapter "Testing and Test Methods."
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with Drawings and the Specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify that the unit is clean.
    e. Ensure that vent path openings are free from debris and that heat-transfer surfaces are clean.
    f. Verify correct connections of circuit boards, wiring, disconnects, and ribbon cables.
    g. Inspect Contactors:

        1) Verify mechanical operation.
        2) Verify that contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

    h. Motor-Running Protection:

        1) Verify that motor FLA is at, or under, the controller current rating.
        2) Verify that overload element setting is correct for its application.
        3) Apply minimum- and maximum-speed set points. Verify that set points are within limitations of the load coupled to the motor.
        4) If motor-running protection is provided by fuses, verify correct fuse rating.

    i. Inspect bolted electrical connections for high resistance using one of the following two methods:

        1) Use a low-resistance ohmmeter. Compare bolted-connection-resistance values to values of similar connections. Investigate values that deviate from

those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12.

j. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

a. **Perform** insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS, Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than this table or manufacturer's written instructions shall be investigated and corrected.

b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

c. Test motor protection devices according to manufacturer's published data.

d. Test circuit breakers as follows:

1) Operate the circuit breaker to ensure smooth operation.

2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.

e. Test the electronic motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.

f. Test the following parameters according to NETA relay calibration procedures, or as recommended by manufacturer:

1) ANSI No. 49R, Overtemperature Protection:

a) Determine time delay at 300 percent of setting.

b) Determine a second point on the operating curve.

c) Determine pickup.

2) ANSI No. 47, Input Phase Loss and Reversed Phases Protection:

a) Determine positive sequence voltage to close the NO contact.

b) Determine positive sequence voltage to open the NC contact (undervoltage trip).

c) Verify negative sequence trip.

d) Determine time delay to close the NO contact with sudden application of 120 percent of pickup.

e) Determine time delay to close the NC contact on removal of voltage when previously set to rated system voltage.

3) ANSI No. 81, Overfrequency Protection:

a) Verify frequency set points.

b) Determine time delay.

c) Determine undervoltage cutoff.

4) Fault Alarm Outputs: Verify that each relay contact performs its intended function in the control scheme including breaker trip tests, close inhibit tests, lockout tests, and alarm functions.

g. Perform operational tests by initiating control devices.

4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.

a. Comply with recommendations of NFPA 70B, Chapter "Testing and Test Methods," Article "Infrared Inspection."
b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:

1) Description of equipment to be tested.
2) Discrepancies.
3) Temperature difference between the area of concern and the reference area.
4) Probable cause of temperature difference.
5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
6) Identify load conditions at time of inspection.
7) Provide photographs and thermograms of the deficient area.
8) Recommended action.

e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
f. Act on inspection results, recommended action, and considering recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

E. Motor controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality-control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.

2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controllers will be considered defective if they do not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain motor controllers.

END OF SECTION 262913.06

SECTION 262923

VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - ENERAL

1.1 SUMMARY

A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

B. Related Requirements:

1.2 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. LED: Light-emitting diode.

F. NC: Normally closed.

G. NO: Normally open.

H. OCPD: Overcurrent protective device.

I. PID: Control action, proportional plus integral plus derivative.

J. RFI: Radio-frequency interference.

K. VFC: Variable-frequency motor controller.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.

1. Include dimensions and finishes for VFCs.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated.

1. Include mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Required working clearances and required area above and around VFCs.
2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
3. Show support locations, type of support, and weight on each support.
4. Indicate field measurements.

B. Qualification Data: For testing agency.

C. Seismic Qualification Data: Certificates, for each VFC, accessories, and components, from manufacturer.

1. Certificate of compliance.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.

D. Product Certificates: For each VFC from manufacturer.

E. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
b. Manufacturer's written instructions for setting field-adjustable overload relays.
c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.

d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
e. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.
f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to **10** percent of quantity installed for each size and type, but no fewer than **three** of each size and type.
2. Control Power Fuses: Equal to **10** percent of quantity installed for each size and type, but no fewer than **two** of each size and type.
3. Indicating Lights: **Two**] <**Insert number**> of each type and color installed.
4. Auxiliary Contacts: Furnish **one** spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish **three** spares for each size and type of magnetic contactor installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and **connect factory-installed space heaters to temporary electrical service**.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ABB, Motion Business.
3. Eaton.
4. Rockwell Automation, Inc.
5. Schneider Electric USA, Inc.
6. Siemens Industry, Inc., Building Technologies Division.
7. Yaskawa Electric America, Inc.

2.2 SYSTEM DESCRIPTION

A. General Requirements for VFCs:

1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and **UL 508A**.

B. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

C. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

D. Output Rating: Three phase; 10 to **60 Hz, with voltage proportional to frequency throughout voltage range**; maximum voltage equals input voltage.

E. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus **10** percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding **3** percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: **97** percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: **98** percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: **65** kA.

7. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet (1000 m).
10. Vibration Withstand: Comply with NEMA ICS 61800-2.
11. Overload Capability: **1.5** times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus **5** percent.
14. Output Carrier Frequency: Selectable; 0.5 to **15** kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

F. Inverter Logic: Microprocessor based, **32** bit, isolated from all power circuits.

G. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: **Electrical**.

H. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: **0.1 to 999.9** seconds.
4. Deceleration: **0.1 to 999.9** seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

I. Self-Protection and Reliability Features:

1. Surge Suppression: **Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2**.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
6. Critical frequency rejection, with **three** selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor-overtemperature fault.

J. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

K. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

L. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

O. Integral Input Disconnecting Means and OCPD: **UL 489, instantaneous-trip circuit breaker** with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: **Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger**.
2. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
4. **NC** alarm contact that operates only when circuit breaker has tripped.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.

2.4 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last [**four**] <**Insert number**> faults with time and date stamp for each.

D. Indicating Devices: Digital display **and additional readout devices as required,** mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of **two** programmable analog inputs: **0- to 10-V dc**.
   b. A minimum of [**six**] <**Insert number**> multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:

   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of **one** programmable analog output signal(s) (**0- to 10-V dc**, which can be configured for any of the following:

   a. Output frequency (Hz).
   b. Output current (load).
   c. DC-link voltage (V dc).
   d. Motor torque (percent).
   e. Motor speed (rpm).
   f. Set point frequency (Hz).

4. Remote Indication Interface A minimum of **two** programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

   a. Motor running.
   b. Set point speed reached.
   c. Fault and warning indication (overtemperature or overcurrent).
   d. PID high- or low-speed limits reached.

F. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports. VFC settings shall be retained within VFC's nonvolatile memory.

1. Hardwired Points:

a. Monitoring: On-off status.
b. Control: On-off operation.

2. Communication Interface: Comply with **ASHRAE 135**. Communication shall interface with DDC system for HVAC to remotely control and monitor lighting from a DDC system for HVAC operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the DDC system for HVAC.

2.5 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.

B. EMI/RFI Filtering:

1. CE marked; certify compliance with IEC 61800-3 for **Category C2.**

2.6 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode:

1. Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor, and retransfer shall only be allowed with the motor at zero speed.
2. Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.

C. Bypass Controller:

1. Three-Contactor-Style Bypass: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller**; with input isolating switch and barrier** arranged to isolate the power converter input and output and permit safe testing **and troubleshooting** of the power converter, both energized and de-energized, while motor is operating in bypass mode.

a. Bypass Contactor: Load-break, **IEC**-rated contactor.
b. Input and Output Isolating Contactors: Non-load-break, **IEC**-rated contactors.

D. Bypass Contactor Configuration: **Full-voltage (across-the-line)** type.

1. NORMAL/BYPASS selector switch.
2. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
3. Contactor Coils: Pressure-encapsulated type[**with coil transient suppressors**].

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

4. Control Circuits: **120**-V ac; obtained from **integral CPT, with primary and secondary fuses**, with **control power source** of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: **50** VA.

5. Overload Relays: NEMA ICS 2.

    a. Melting-Alloy Overload Relays:

        1) Inverse-time-current characteristic.
        2) **Class 10** tripping characteristic.
        3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

    b. Bimetallic Overload Relays:

        1) Inverse-time-current characteristic.
        2) **Class 10** tripping characteristic.
        3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

    c. Solid-State Overload Relays:

        1) Switch or dial selectable for motor-running overload protection.
        2) Sensors in each phase.
           Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

    d. **NC** isolated overload alarm contact.
    e. External overload, reset push button.

2.7 OPTIONAL FEATURES

A. Damper control circuit with end-of-travel feedback capability.

B. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

C. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

2.8 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: T**ype 1**
2. Outdoor Locations: **Type 3R**.
3. **Kitchen** or **Wash-Down** Areas: **Type 4X**.
4. Other Wet or Damp Indoor Locations: **Type 4**.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.9 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons: **Covered**.
2. Pilot Lights: Push to test.
3. Selector Switches: **Rotary** type.
4. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. **Reversible NC/NO** bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable [**pneumatic**] [**solid-state**] time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

E. Supplemental Digital Meters:

1. Elapsed-time meter.
2. Kilowatt meter.
3. Kilowatt-hour meter.

F. Breather anddrain assemblies, to maintain interior pressure and release condensation in NEMA 250, **Type 4** and **Type 4X** enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, **Type 3R** enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

2.10 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in **NEMA ICS 61800-2**.

1. Test each VFC while connected to i**ts specified motor**.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.

1. Curbs and roof penetrations are specified in Section 077200 "Roof Accessories."
2. Structural-steel channels are specified in Section 260529 "Hangers and Supports for Electrical Systems."

D. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Install fuses in each fusible-switch VFC.

G. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

H. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

I. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices[**and facility's central-control system**]. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: **Engage** a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections **with the assistance of a factory-authorized service representative**.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. **Test and adjust controllers, components, and equipment.**
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify **Construction Manager** before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFCs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. **Perform** startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify **Construction Manager** before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges[**as specified in Section 260573.16 "Coordination Studies."**

F. Set field-adjustable pressure switches.

3.8 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

SECTION 264313

SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type 1 surge protective devices (SPDs).
2. Type 2 surge protective devices (SPDs).
3. Type 3, Type 4, and Type 5 surge protective devices (SPDs).
4. Enclosures.
5. Conductors and cables.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 262413 "Switchboards" for integral SPDs installed by switchboard manufacturer.
4. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.
5. Section 262726 "Wiring Devices" for integral SPDs installed by receptacle manufacturer.

1.2 DEFINITIONS

A. I_n: Nominal discharge current.

B. Maximum Continuous Operating Voltage (MCOV): The maximum designated RMS value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

C. Metal-Oxide Varistor (MOV): An electronic component with a significant bidirectional, nonlinear current-voltage characteristic.

D. Mode(s), Modes of Protection, or Protection Modes: Electrical paths where the SPD offers defense against transient overvoltages. Examples include: line to neutral (L-N), line to ground (L-G), line to line (L-L), and neutral to ground (N-G).

E. SCCR: Short-circuit current rating.

F. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.

G. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.

H. Type 3 SPDs: Point of utilization SPDs.

I. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.

J. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.

K. Voltage Protection Rating (VPR): A rating selected from UL 1449 list of preferred values assigned to each mode of protection.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include electrical characteristics, specialties, and accessories for SPDs.
b. Certification of compliance with UL 1449 by qualified electrical testing laboratory recognized by authorities having jurisdiction including the following information:

1) Tested values for VPRs.
2) I_n ratings.
3) MCOV, type designations.
4) OCPD requirements.
5) Manufacturer's model number.
6) System voltage.
7) Modes of protection.

B. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 WARRANTY

A. Special Manufacturer Extended Warranty: Manufacturer warrants that SPDs perform in accordance with specified requirements and agrees to provide repair or replacement of SPDs that fail to perform as specified within extended warranty period.

1. Initial Extended Warranty Period: **Five** year(s) from date of Substantial Completion, for labor, materials, and equipment.
2. Follow-On Extended Warranty Period: **10**] year(s) from date of Substantial Completion, for materials only, f.o.b. the nearest shipping point to Project site.

PART 2 - PRODUCTS

2.1 TYPE 1 SURGE PROTECTIVE DEVICES (SPDs)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Business.
2. Advanced Protection Technologies Inc. (APT).
3. Citel, Inc.
4. Eaton.
5. Intermatic, Inc.
6. Leviton Manufacturing Co., Inc.
7. Liebert; Vertiv Holdings Co.
8. Mersen USA.
9. RAYCAP.
10. SSI, an ILSCO Company.
11. Schneider Electric USA, Inc.
12. Siemens Industry, Inc., Energy Management Division.
13. Thor Systems.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. General Characteristics:

1. Reference Standards: UL 1449, Type 1.
2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than **200** kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
4. Protection modes and UL 1449 VPR for grounded wye circuits with **480Y/277 V** and **208Y/120 V**, three-phase, four-wire circuits must not exceed the following:

    a. Line to Neutral: **1200 V for 480Y/277 V**, **700 V for 208Y/120 V**.
    b. Line to Line: **2000 V for 480Y/277 V**, **1200 V for 208Y/120 V**.

5. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits must not exceed the following:

    a. Line to Neutral: 700 V.
    b. Line to Line: 1200 V.

6. SCCR: Not less than **200** kA.
7. I_n Rating: 20 kA.

D. Options:

1. Include integral disconnect switch.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include indicator light display for protection status.
4. Include audible alarm.
5. Include NEMA ICS 5, dry Form C contacts rated at [**2 A and 24 V(ac)**] <**Insert values**> for remote monitoring of protection status.
6. Include surge counter.

2.2 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB, Electrification Business.
2. ALLTEC LLC.
3. Advanced Protection Technologies Inc. (APT).
4. Citel, Inc.
5. Eaton.
6. Leviton Manufacturing Co., Inc.
7. Liebert; Vertiv Holdings Co.
8. Mersen USA.
9. RAYCAP.
10. SSI, an ILSCO Company.
11. Schneider Electric USA, Inc.
12. Siemens Industry, Inc., Energy Management Division.
13. Thor Systems.

B. Source Limitations: Obtain devices from single source from single manufacturer.

C. General Characteristics:

1. Reference Standards: UL 1449, Type 2[**; UL 1283**.
2. MCOV: Not less than 125 percent of nominal system voltage for 208Y/120 V and 120/240 V power systems, and not less than 115 percent of nominal system voltage for 480Y/277 V power systems.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase must not be less than **100** kA. Peak surge current rating must be arithmetic sum of the ratings of individual MOVs in a given mode.
4. Protection modes and UL 1449 VPR for grounded wye circuits with [**480Y/277 V**] [**208Y/120 V**], three-phase, four-wire circuits must not exceed the following:

    a. Line to Neutral: **1200 V for 480Y/277 V**, **700 V for 208Y/120 V**.
    b. Line to Ground: **1200 V for 480Y/277 V**, **700 V for 208Y/120 V**.
    c. Neutral to Ground: **1200 V for 480Y/277 V**, **700 V for 208Y/120 V**.
    d. Line to Line: **2000 V for 480Y/277 V**, **1200 V for 208Y/120 V**.

5. SCCR: Equal or exceed **100** kA.
6. I_n Rating: **20** kA.

D. Options:

1. Include LED indicator lights for power and protection status.
2. Include internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include NEMA ICS 5, dry Form C contacts rated at **2 A and 24 V(ac)** for remote monitoring of protection status.
4. Include surge counter.

2.3 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)

A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation. **See "Related Requirements" Paragraph in "Summary" Article for products with manufacturer-installed Type 3, Type 4, and Type 5 SPDs.**

2.4 ENCLOSURES

A. Indoor Enclosures: Type 1.

B. Outdoor Enclosures: **Type 4X**.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's instructions.

B. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's instructions. Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
2. Do not exceed manufacturer's recommended lead length.
3. Do not bond neutral and ground.

C. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Compare equipment nameplate data for compliance with Drawings and the Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's installation requirements.

C. Nonconforming Work:

1. SPDs that do not pass tests and inspections will be considered defective.
2. Remove and replace defective units and retest.

D. Prepare test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to **support** field tests and inspections.

3.3 STARTUP SERVICE

A. Complete startup checks in accordance with manufacturer's instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

END OF SECTION 264313

SECTION 265000

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaires.
2. Luminaire fittings.
3. Electric-discharge lamp control equipment.
4. Lamps.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" specifies additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" specifies seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.
3. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables" specifies wiring connections installed by this Section.
4. Section 260529 "Hangers and Supports for Electrical Systems" specifies channel and angle supports installed by this Section.
5. Section 260553 "Identification for Electrical Systems" specifies electrical equipment labels and warning signs installed by this Section.
6. Section 260923 "Lighting Control Devices" specifies automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors installed by this Section.

1.2 DEFINITIONS

A. BUG Rating: Backlight, uplight, and glare rating for light pollution from exterior luminaires.

B. CMH: Ceramic metal halide.

C. Correlated Color Temperature (CCT): The absolute temperature (in kelvins) of a blackbody whose chromaticity (color quality) most nearly resembles that of the light source.

D. Color Rendering Index (CRI): The measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference light source. The lower the CRI of a light source, the more difficult it is to identify colors and stripes on electronic components and wiring.

E. HPS: High-pressure sodium.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For luminaires.

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Product Certificates: Include product certificates stating compliance with standards listed below, signed by manufacturer or fabricator.

1) Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with current accreditation under National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
2) Testing Agency Certified Data: For luminaires indicated on Lighting Fixture Schedule on Drawings, photometric data certified by qualified independent testing laboratory. Photometric data for remaining luminaires must be certified by manufacturer.

c. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
d. Include operating characteristics, electrical characteristics, and furnished accessories.
e. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
f. Include battery and charger data for emergency lighting units.
g. Include ballast factor.
h. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
i. Include photometric data and adjustment factors obtained from qualified laboratory tests.
j. Include manufacturer's sample warranty language.

2. For luminaire fittings

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.

2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
c. Include operating characteristics, electrical characteristics, and furnished accessories.
d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
e. Include manufacturer's sample warranty language.

3. For lamps.

a. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.

1) If listed manufacturer differs from selling manufacturer, indicate relationship between entities on submittal. Clearly indicate which entity warrants product performance and fitness for purpose.
2) Listing criteria identified in approval letter must match specified listing criteria. Approval of only equipment's enclosure is not considered approval of equipment for intended application.
3) Product identification in approval letter must match product branding and model numbers in submittal. Approval letters for similar products are not acceptable.

b. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
c. Include operating characteristics, electrical characteristics, and furnished accessories.
d. Include schedule of submitted lighting products. Arrange schedule and accompanying product data in order by luminaire and lamp designations indicated on Drawings.
e. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
f. Include manufacturer's sample warranty language.

B. Sustainable Design Product Data:

1. For luminaires.
a. Energy Efficiency: Submit product certificate indicating luminaire is certified by Energy Star or Design Lights Consortium.
b. Energy Usage: Submit product data showing compliance with ASHRAE 90.1.
c. BUG Ratings: Submit product data indicating BUG ratings of all installed exterior luminaires.
d. Luminaire Calculations: Submit product data indicating lumen emittance and vertical illuminance.
e. Environmental Product Declaration: For each product.
f. Health Product Declaration: For each product.
g. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

h. Third-Party Certifications: For each product.
i. Third-Party Certified Life Cycle Assessment: For each product.

2. For luminaire fittings.

a. Environmental Product Declaration: For each product.
b. Health Product Declaration: For each product.
c. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
d. Third-Party Certifications: For each product.
e. Third-Party Certified Life Cycle Assessment: For each product.

3. For lamps.
a. Environmental Product Declaration: For each product.
b. Health Product Declaration: For each product.
c. Third-Party Certifications: For each product.
d. Third-Party Certified Life Cycle Assessment: For each product.

C. Samples:

1. For luminaires.

a. One for each kind of luminaire fitting with specified rating, size, finish, color, and texture.

2. For luminaire fittings.

a. One for each kind of luminaire fitting with specified rating, size, finish, color, and texture.

3. For lamps.

a. One for each kind of lamp with specified rating, size, base, and color.

D. Shop drawings.

E. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions.

B. Field Reports:

1. Manufacturer's field reports for field quality-control support.
2. Manufacturer's field reports for system startup support.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare parts.

B. Extra stock material.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect exposed surface finishes on lighting equipment by applying strippable, temporary protective covering before shipping.

1.8 WARRANTY FOR LUMINAIRES

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed luminaires perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period. Warranty must convey to Owner upon acceptance of the Work.

1. Extended-Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

1.9 WARRANTY FOR BATTERIES

A. Special Manufacturer Extended Warranty for Batteries: Manufacturer warrants that batteries perform in accordance with specified requirements and agrees to provide repair or replacement of batteries that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period for Li-ion Batteries: Five years from date of Substantial Completion; full coverage for materials only, free on board [origin] [destination], freight prepaid.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. See individual product types below for listing criteria.
c. Marked in accordance with UL CCN HYXT, including UL 1598, for compatible power supply, installation location, and environmental conditions.

B. Source Quality Control:

1. Compile and submit product data.
2. Compile and submit sustainable design product data.

3. Compile and submit samples.

C. Surface-Mounted Luminaire: Refer to fixture schedule on drawings.

D. Recessed Luminaire: Refer to fixture schedule on drawings.

E. UL IFFR - Track-Lighting Systems: Refer to fixture schedule on drawings.

F. UL FTBR or FTBV - Emergency Lighting and Power Equipment: Refer to fixture schedule on drawings.

G. UL FWBO - Exit Fixture: Refer to fixture schedule on drawings.

H. UL FWBX - Self-Luminous or Photoluminescent Exit Sign: Refer to fixture schedule on drawings.

2.2 LUMINAIRE FITTINGS

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
b. See individual product types below for listing criteria.

B. Source Quality Control:

1. Compile and submit product data.
2. Compile and submit sustainable design product data.
3. Compile and submit samples.

C. Luminaire Support Accessories:

1. Product Characteristics:

a. Sized and rated for luminaire weight.
b. Capable of maintaining luminaire position after cleaning and relamping.
c. Capable of supporting luminaire without causing deflection of ceiling or wall.
d. Capable of supporting horizontal force equal to 100 percent of luminaire weight and vertical force equal to 400 percent of luminaire weight.

2. Required Product Options:

a. Hook Hangers: Integrated assembly matched to luminaire, supply voltage, and equipment with threaded attachment, cord, and locking-type plug.
b. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)] <Insert size> wire supports adjustable to 10 ft (3 m) in length.
c. Aircraft Cables:[5/32 inch (4 mm) diameter aircraft cable supports adjustable to required length.
d. Single-Stem Hangers: 1/2 inch (13 mm) nominal diameter steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

e. Rod Hangers: 3/16 inch (5 mm) nominal diameter, cadmium-plated, threaded steel rod.

2.3 LAMPS

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Source Quality Control:

1. Compile and submit product data.
2. Compile and submit sustainable design product data.
3. Compile and submit samples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Shop Drawings: Prepare and submit the following:

1. Drawings, Diagrams, and Supporting Documents for Custom Luminaires:

a. Include plans, elevations, sections, and mounting and attachment details.
b. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
c. Include diagrams for power, signal, and control wiring.

B. Temporary Lighting: If approved by Architect, specified luminaires for Project may be installed for temporary lighting. Install and energize minimum quantity of luminaires necessary to meet needs of construction activities. When construction is sufficiently complete, remove, disassemble, clean, and relamp luminaires used for temporary lighting before reinstalling for Project delivery.

3.3 SELECTION OF LIGHTING

A. Finished Spaces:

1. Location: See lighting drawings.

B. Unfinished Spaces:

1. Location: See lighting drawings.

2. INSTALLATION OF LIGHTING

C. Comply with manufacturer's published instructions.

D. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Installation of Indoor Lighting Systems: NECA NEIS 500.
2. Installation of Exterior Lighting Systems: NECA NEIS 501.
3. Installation of Industrial Lighting Systems: NECA NEIS 502.
4. Installation of Luminaires, Lampholders, and Lamps: Article 410 of NFPA 70.
5. Installation of Extra-Low-Voltage Lighting: Article 411 of NFPA 70.
6. Installation of Lighting for Sensitive Electronic Equipment: Article 647 of NFPA 70.
7. Installation of Emergency Lighting and Exit Signs: ICC IBC, NFPA 101, and Parts IV and V in Article 700 of NFPA 70.
8. Consult Architect for resolution of conflicting requirements.

E. Special Installation Techniques:

1. Install luminaires level, plumb, and square with finished floor or grade unless otherwise indicated.
2. Install luminaires at height and aiming angle as indicated on Drawings.
3. Coordinate layout and installation of luminaires with other construction.
4. Adjust luminaires that require field adjustment or aiming. [Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.]
5. Exterior Bollard Luminaires:

    a. Align units for optimum directional alignment of light distribution.
    b. Install on concrete base with top [4 inch (100 mm)] <Insert dimension> above finished grade or surface at luminaire location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

6. Exterior In-Ground Luminaires:

    a. Install on concrete base with top [4 inch (100 mm)] <Insert dimension> above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

7. Exterior Corrosion Prevention:

a. Do not use aluminum in contact with earth or concrete. When in direct contact with dissimilar metals, protect aluminum with insulating fittings or treatment.
b. When embedding steel conduits in concrete, wrap conduit with 10 mil (0.254 mm) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

8. Flush-Mounted Luminaire Support:

a. Secured to outlet box.
b. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
c. Trim ring flush with finished surface.

9. Wall-Mounted Luminaire Support:

a. Attached to structural members in walls.
b. Do not attach luminaires directly to gypsum board.

10. Suspended Luminaire Support:

a. Ceiling Mount:

1) Hook hangers.

b. Pendants and Rods: Where longer than 48 inch (1220 mm), brace to limit swinging.
c. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
d. Continuous Rows of Luminaires: Provide tubing or stem for wiring at one point and tubing or rod, or wire support for suspension for each unit length of luminaire chassis, including one at each end.
e. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

11. Ceiling-Grid-Mounted Luminaire Support:

a. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inch (150 mm) from luminaire corners.
b. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for application.
c. Luminaires of Sizes Smaller Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with no fewer than two 3/4 inch (20 mm) metal channels spanning and secured to ceiling tees.
d. Seismic Restraint: Install at least one independent support rod or wire from structure to tab on luminaire. Wire or rod must have breaking strength for luminaire weight with safety factor of 3.

12. Remote Mounting of Ballasts: Do not exceed distance between ballast and luminaire recommended by ballast manufacturer.
13. Emergency Power Units: Secure with approved fasteners in four or more locations, spaced near corners of unit.
14. Install wiring connections for luminaires.

15. Identification: Provide labels for luminaires and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each enclosure with engraved metal or laminated-plastic nameplate.

F. Systems Integration: Integrate lighting control devices and equipment with electrical power connections for operation of luminaires as specified.

3.4 FIELD QUALITY CONTROL OF LIGHTING

A. Field tests and inspections must be witnessed by authorities having jurisdiction] <Insert names or titles of witnesses.

B. Tests and Inspections:

1. Perform manufacturer's recommended tests and inspections.
2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
3. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
4. Verify operation of photoelectric controls.
5. Exterior Illumination Tests:

    a. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.

C. Nonconforming Work:

1. Luminaire will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services: Engage factory-authorized service representative to support field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.5 SYSTEM STARTUP

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.
2. Burn-in lamps that require specific aging period to operate properly, prior to occupancy by Owner.
3. Charge emergency power units and batteries minimum of one hour and depress switch to conduct short-duration test.
4. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

B. Manufacturer Services: Engage factory-authorized service representative to support system startup.

1. Manufacturer's Field Reports for System Startup Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

3.6 ADJUSTING

A. Luminaire Aiming Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aiming direction of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
3. Adjust aim of luminaires in presence of Architect.

3.7 CLOSEOUT ACTIVITIES

A. Maintenance Material Submittals:

1. Spare Parts: Furnish to Owner spare parts, for repairing lighting equipment, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

   a. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   b. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

2. Extra Stock Material: Furnish to Owner extra materials, from same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Include the following:
   a. Luminaire-Mounted Emergency Battery Packs: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

3.8 PROTECTION

A. After installation, protect lighting equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 265000

SECTION 265613

LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel poles.
2. Aluminum poles.
3. Fiberglass poles.
4. Laminated wood poles.
5. Wood poles.
6. Prestressed concrete poles.
7. Pole accessories.
8. Lowering system for luminaires.
9. Mounting hardware.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260011 "Facility Performance Requirements for Electrical" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

1.2 DEFINITIONS

A. EPA: Equivalent projected area.

B. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

C. Standard: See "Pole."

1.3 ACTION SUBMITTALS

A. Product Data:

1. Steel poles.
2. Aluminum poles.
3. Fiberglass poles.
4. Laminated wood poles.
5. Wood poles.
6. Prestressed concrete poles.
7. Pole accessories.
8. Lowering system for luminaires.
9. Mounting hardware.

B. Shop Drawings:

1. Include plans, elevations, sections, and **mounting and attachment** details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of **poles and pole accessories**.
4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

C. Samples:

1. Steel poles.
2. Aluminum poles.
3. Fiberglass poles.
4. Laminated wood poles.
5. Wood poles.
6. Prestressed concrete poles.
7. Pole accessories.
8. Lowering system for luminaires.

D. Sustainable Design Submittals:

1. Steel poles.
2. Aluminum poles.
3. Fiberglass poles.
4. Laminated wood poles.
5. Wood poles.
6. Prestressed concrete poles.
7. Pole accessories.
8. Lowering system for luminaires.

E. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports:

1. For each foundation component, by qualified testing laboratory.
2. For each pole, by qualified testing laboratory.

B. Soil test reports.

C. Manufacturers' published instructions.

D. Field Reports:

1. Manufacturer's field reports for field quality-control support.

1.5 CLOSEOUT SUBMITTALS

A. Warranty documentation.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts and Special Tools: Furnish to Owner spare parts, proprietary equipment, and keys required to operate, maintain, repair, adjust, or implement future changes to poles, that are packaged with protective covering for storage on-site and identified with labels describing contents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping in accordance with ASTM B660.

Retain first paragraph below for all pole types.

B. Store poles on decay-resistant skids at least 12 inch (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole installed below finished grade.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.8 WARRANTY

A. Special Installer Extended Warranty: Installer warrants that fabricated and installed [**ole(s)**] [**nd luminaire-lowering device(s)**] perform in accordance with specified requirements and agrees to repair or replace products that fail to perform as specified within extended-warranty period.

1. Extended-Warranty Period: **Two** years from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage qualified professional engineer(s) to design pole foundation and pole power system.

B. Structural Characteristics: Comply with AASHTO LTS-6-M.

C. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied in accordance with AASHTO LTS-6-M.

D. Live Load: Single load of 500 lb (2200 N) distributed in accordance with AASHTO LTS-6-M.

E. Ice Load: Load of 3 lb/ft^2 (145 Pa), applied in accordance with AASHTO LTS-6-M for applicable areas on the Ice Load Map.

F. Wind Load for Poles Exceeding 50 ft (15 m) Height:

1. Basic Wind Speed: **100 mile/h (45 m/s)**.
2. Wind Importance Factor: **1.0**.
3. Minimum Design Life: **50 years**.
4. Velocity Conversion Factor: **1.0**.

G. Wind Load for Poles Not Exceeding 50 ft (15 m) Height:

1. Basic Wind Speed: **100 mile/h (45 m/s)**.
2. Wind Importance Factor: **1.0**.
3. Minimum Design Life: **25 years**.
4. Velocity Conversion Factor: **1.0**.

H. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of **1.1** to obtain the EPA used in pole selection strength analysis.

I. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless steel fasteners and mounting bolts unless otherwise indicated.

J. General Finish Requirements:

1. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.2 STEEL POLES

A. <Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American LitePole.
2. Appleton; Emerson Electric Co., Automation Solutions.
3. Bridgewell Resources.
4. Cooper Lighting Solutions; Signify North America Corp.
5. E-conolight.
6. H.E. Williams.
7. Hapco.
8. Hubbell Electrical Solutions; Hubbell Incorporated.
9. Kim Lighting; brand of GE Current, a Daintree company; American Industrial Partners (AIP).
10. LSI Industries.
11. Lithonia Lighting; Acuity Brands Lighting, Inc.
12. Millerbernd Manufacturing Company.
13. NAFCO; brand of Wisconsin Lighting Lab, Inc.
14. RAB Lighting.
15. Ruud Lighting; brand of Cree Lighting; subsidiary of Ideal Industries, Inc.

16. Union Metal Industries Corp.

B. Source Limitations: **Obtain poles from single manufacturer or producer** .

C. Carbon-Steel Poles: Comply with ASTM A500/A500M, Grade B carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 ft (12 m) in height with access handhole in pole wall.

1. Shape: **Round, tapered**; **Round, straight**; **Square, tapered**; **Square, straight**; per drawings.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

D. Stainless Steel Poles: Comply with **ASTM A240/A240M**, stainless steel with a minimum yield of 55,000 psig (379 MPa); one-piece construction up to 40 ft (12 m) in height with access handhole in pole wall.

1. Shape: **Round, tapered**; **Round, straight**; **Square, tapered**; **Square, straight**; per drawings.

2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

E. Steel Mast Arms: **Single-arm**, **Truss** or **Davit** type, continuously welded to pole attachment plate. Material and finish same as plate.

F. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with [**stainless**] [**galvanized**]-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

G. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

H. Fasteners: **Stainless steel** or **Galvanized steel**, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

I. Grounding and Bonding Lugs: Welded 1/2 inch (13 mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

J. Steps: Fixed steel, with nonslip treads.

1. For climbing positions, install at 15 inch (381 mm) vertical spacing, alternating on opposite sides of pole, oriented 180 degrees from each other; first step must be at an elevation 10 ft (3 m) above finished grade.

2. For working positions, install steps on opposite side of pole, oriented 180 degrees from each other at the same elevation.

K. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

L. Intermediate Handhole and Cable Support: Weatherproof, 3-by-5 inch (76-by-130 mm) handhole located at midpoint of pole, with cover for access to internal welded attachment lug for electric cable support grip.

M. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.

N. Platform for Lamp Ballast Servicing: Factory fabricated of steel, with finish matching that of pole.

O. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

P. Galvanized Finish: After fabrication, hot-dip galvanize in accordance with ASTM A123/A123M.

Q. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high gloss, high-build polyurethane enamel.

    a. Color: **As selected by Architect from manufacturer's full range**.

R. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder Coat: Comply with AAMA 2604.

    a. Electrostatic-applied powder coating; single application and cured to a minimum 2.5 to 3.5 mil (64 to 89 µm) dry film thickness. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: **As selected by Architect from manufacturer's full range**.

2.3 ALUMINUM POLES

A. <Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American LitePole.
2. Appleton; Emerson Electric Co., Automation Solutions.

3. Bridgewell Resources.
4. Cooper Lighting Solutions; Signify North America Corp.
5. E-conolight.
6. H.E. Williams.
7. Hapco.
8. Hubbell Electrical Solutions; Hubbell Incorporated.
9. Kim Lighting; brand of GE Current, a Daintree company; American Industrial Partners (AIP).
10. LSI Industries.
11. Lithonia Lighting; Acuity Brands Lighting, Inc.
12. Lyte Poles; brand of DWM Holdings, Inc.
13. NAFCO; brand of Wisconsin Lighting Lab, Inc.
14. Ruud Lighting; brand of Cree Lighting; subsidiary of Ideal Industries, Inc.
15. Sentry Electric, LLC.
16. Union Metal Industries Corp.
17. Valmont Industries, Inc.

B. Poles: **Seamed** or **Seamless**, extruded structural tube complying with ASTM B221, **Alloy 6063-T6**, with access handhole in in pole wall.

1. Shape: **Round, tapered**; **Round, straight**; **Square, tapered**; **Square, straight**; per drawings. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Mast Arms: [**Aluminum**] [**Steel**] [**Single-arm**] [**Truss**] [**Davit**] type, continuously welded to pole attachment plate. Material and finish same as plate.

D. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with **stainless** or **galvanized**-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

E. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

F. Grounding and Bonding Lugs: Bolted 1/2 inch (13 mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

G. Fasteners: [**Stainless steel**] [**Galvanized steel**] <**Insert finish or grade**>, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

H. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

I. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

J. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

K. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

L. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Powder coat must comply with AAMA 2604.

    a. Electrostatic applied powder coating; single application with a minimum 2.5 to 3.5 mil (64 to 89 µm) dry film thickness; cured in accordance with manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
    b. Color: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

2.4 FIBERGLASS POLES

A. <Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Alliance; a division of GEOTEK.
2. Bridgewell Resources.
3. CMT; a Valmont Company.

4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. PLP Composite Technologies, Inc.
6. Shakespeare; a Valmont Company.
7. Valmont Industries, Inc.
8. Whately; a Valmont Company.
9. Wood Preservers, Inc.

B. Poles:

1. Designed specifically for supporting luminaires, with factory-formed cable entrance and handhole.
2. Not less than 65 percent by weight of fiberglass roving, with resin and pigment making up the remainder.
3. Roving must be continuously applied with uniform tension, with multiple layers placed to meet axial and compressive strength requirements.
4. Shape: **Round, tapered**; **Round, straight**; **Square, tapered**; **Square, straight**; per drawings. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
5. Resin Color: [**Black**] [**Dark**] [**Bronze**] <**Insert Color**>; uniform coloration throughout entire wall thickness.
6. Surface Finish: Smooth and uniform along surface of pole.
7. Paint Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mil (40 µm). Polyurethane may be omitted if the surface layer of the pole is inherently UV inhibited.

C. Mast Arms: [**Aluminum**] [**Steel**] [**Fiberglass**] [**Single-arm**] [**Truss**] [**Davit**] type, continuously welded to pole attachment plate. Material and finish same as plate. Adaptor plate must be steel hot-dip galvanized in accordance with ASTM A153 or 6061-T6 aluminum encased within fiberglass roving, allowing the mast arm adaptor to be bolted to the pole.

D. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting: Steel, hot-dip galvanized in accordance with ASTM A153, or 6061-T6 aluminum, permanently bonded within fiberglass roving, allowing the bracket to be bolted to the pole-mounted adapter. Bolt together with [**stainless**] [**galvanized**]-steel bolts; use anti-seize compound when bolting dissimilar metals.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

E. Pole-Top Tenons: Steel, hot-dip galvanized in accordance with ASTM A153, or 6061-T6 aluminum, permanently bonded to the fiberglass shaft. Fabricated to support luminaire or luminaires and brackets indicated.

F. Fasteners: [**Stainless steel**] [**Galvanized steel**] <**Insert finish or grade**>, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Handhole: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

Retain "Grounding" Paragraph for installations requiring a ground conductor.

H. Grounding: Bare, stranded copper, 6 AWG, **suspended inside of pole**, connected to luminaire(s), ground lug near handhole and ground rod.

I. Grounding and Bonding Lugs: Bolted 1/2 inch (13 mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

J. Anchor Base: Integral galvanized steel or aluminum casting, enclosing and permanently bonded to the exterior of the fiberglass shaft.

2.5 LAMINATED WOOD POLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bell Lumber and Pole Company.
2. Hughes Brothers, Inc.
3. Laminated Wood Systems, Inc.
4. Lithonia Lighting; Acuity Brands Lighting, Inc.
5. McFarland Cascade.
6. Timber Technologies, LLC.
7. TimberWood Products; J.H. Baxter & Co.
8. Valmont Industries, Inc.

B. Species and Grades for Structural Laminated Timber: Complying with ANSI A190.1. Use [**Southern pine**] [**Douglas fir**] [**Alaska cedar**] [**any species listed in AITC 117**], engineered and fabricated to withstand indicated structural loads without exceeding allowable design working stresses in accordance with [**AITC 117**] [**ANSI O5.2**].

C. Features include [**wood bracket**] [**wood crossarm**] [**pole-top adaptor**] <**Insert items**> for mounting luminaire(s), metal pole cap, and concealed raceway path connected to access handhole.

D. Mounting Provisions: [**Embedded**] <**Insert description of other mounting unless detailed on Drawings**>.

E. Fasteners: [**Stainless steel**] [**Galvanized steel**] <**Insert finish or grade**>, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

F. Appearance Grade: Architectural appearance grade complying with AITC 110.

G. Preservative Treatment:

1. Exposure: Comply with **AWPA UC4A**.
2. Treatment after Dressing and End Cutting: Comply with AWPA M4 for surface cuts to a depth of more than 1/16 inch (1.6 mm).

H. Adhesive: Wet-use type complying with ASTM D2559.

I. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

J. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

K. Finish: [**Natural, unstained wood**] [**Semitransparent stain applied after erection**] [**Factory-applied semitransparent stain**], color as selected by Architect.

2.6 WOOD POLES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. American Pole & Timber.
2. Baldwin Pole & Piling Co., Inc.
3. Bell Lumber and Pole Company.
4. Cavawood Architectural Products.
5. Cobb Lumber Company.
6. Cox Utility Products Division.
7. Guelph Utility Pole Co., Ltd.; a Stella-Jones company.
8. Koppers Performance Chemicals.
9. Langdale Forest Products Company.
10. Lithonia Lighting; Acuity Brands Lighting, Inc.
11. McFarland Cascade.
12. Stella-Jones.
13. T.R. Miller Mill Co., Inc.
14. Texas Electric Cooperatives, Inc.
15. Thomasson Company.
16. TimberWood Products; J.H. Baxter & Co.
17. United Wood Treating Company.
18. Wood Preservers, Inc.

B. Poles: [**Douglas fir**] [**Southern yellow pine**], [**machine trimmed by turning,**] for wood species used; and bored, roofed, and grained before treatment.

1. Pole Brand: Brand the manufacturer's trademark and date of treatment, height and class of pole, wood species, preservation code, and retention. Brand must be placed so that the bottom of the brand is minimum 10 ft (3 m) from pole butt.
2. Mounting Provisions: Embedded.

C. Fasteners: [**Stainless steel**] [**Galvanized steel**] <**Insert finish or grade**>, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

D. Preservative Treatment: Treat in accordance with **AWPA UC4A**.

E. Luminaire Brackets: Comply with ANSI C136.13.

2.7 POLE ACCESSORIES

A. Duplex Receptacle where indicated on drawings: Ground-fault circuit interrupter type, 120 V ac, 20 A in a weatherproof assembly. Comply with requirements in Section 262726 "Wiring Devices."

1. **Recessed 12 inch (300 mm)** above finished grade.

a. NEMA 250, **Type 3R**, nonmetallic polycarbonate plastic or reinforced fiberglass, enclosure with cover; color to match pole.
b. Lockable hasp and latch complying with OSHA lockout and tag-out requirements.

B. Minimum 1800 W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

D. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept **indicated accessories**. Include removable flanged access cover secured with bolts or screws.

E. Decorative accessories, supplied by decorative pole manufacturer, include the following:

1. Banner Arms: <**Insert material**>.
2. Flag Holders: <**Insert material**>.
3. Ladder Rests: <**Insert material**>.

2.8 LOWERING SYSTEM FOR LUMINAIRES

A. System Description: Capable of lowering luminaire **assembly** to a service position within 36 inch (900 mm) of finished grade in winds up to 30 mile/h (49 km/h). Provide manual plug connection to electrical power accessible in lowered position. Assembled system of pole, luminaire, and lowering device must be capable of loads specified in "Performance Requirements" Article.

B. Compatibility of Material: Materials for attachment and connection of luminaire-mounting assembly, lowering device, lowering cable, and portable winch must be compatible to avoid corrosion and electrolysis.

C. Structural and Mechanical Design Safety Factor: 5.0, minimum, for static and dynamic loads of load-bearing components, including cable.

D. Luminaire-Mounting and Disconnect Arrangement: Multiple [**ring**] [**carriage**]-mounted luminaires, arranged for lowering and rising as a group.

1. Electrical cable for normal operating power to luminaires must manually disconnect inside pole base, using weatherproof multi-pin connector, and must be arranged to move within the pole during lowering and rising of luminaire assembly.
2. Electrical cable for normal operating power to luminaires must automatically disconnect at weatherproof multi-pin connector within the pole-top lowering head at the beginning of the lowering cycle and reconnect when luminaire or luminaire assembly is raised to the operating position.

E. Lowering Device: Weatherproof, cast-aluminum housing, and multiple mechanical latches. Moving parts of latching assembly must be located in the portion of the unit that is lowered to servicing position. Positive latching in the operating position must be indicated to the operator at the base of the pole by a clear visual signal or by other means acceptable to Owner or authorities having jurisdiction.

F. Lowering Cable: **Zinc-electroplated or stainless** steel aircraft cable.

2.9 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured **to ASTM F1554, Grade 55,** with a minimum yield strength of 55,000 psi (380 000 kPa).

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1. Galvanizing: **Hot dip galvanized in accordance with ASTM A153, Class C**.
2. [**Bent**] [**Headed**] rods <**Insert dimension**> in diameter by <**Insert dimension**> in length.
3. Threading: **Uniform National Coarse**, Class 2A.

B. Nuts: ASTM A563, Grade A, Heavy-Hex.

1. Galvanizing: **Hot dip galvanized in accordance with ASTM A153, Class C**.
2. **Two** nuts provided per anchor bolt **, shipped with nuts pre-assembled to the anchor bolts**.

C. Washers: ASTM F436, Type 1.

1. Galvanizing: **Hot dip galvanized in accordance with ASTM A153, Class C.**
2. **Two** washer(s) provided per anchor bolt.

2.10 SOURCE QUALITY CONTROL

A. Product Data: Prepare and submit catalog cuts, brochures, **diagrams, schedules,** and performance data illustrating size, physical appearance, and other characteristics of product.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
2. Include finishes for lighting poles and luminaire-supporting devices.
3. Anchor bolts.
4. Manufactured pole foundations.
5. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in accordance with AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification must be based on design calculations signed and sealed by a professional engineer.
6. Include sample warranty language.

B. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. Samples: Submit finish samples for each exposed lighting pole, standard, and luminaire-supporting device and for each color and texture specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Pre-Cast Foundations: Factory fabricated, with structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

C. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A36/A36M and hot-dip galvanized in accordance with ASTM A123/A123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

D. Direct-Buried Foundations: Install to depth indicated on Drawings, but not less than **one-sixth of pole height** or **as indicated**. Add backfill **in 6 inch (150 mm) to 9 inch (230 mm) layers, tamping each layer before adding the next**. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

E. Direct-Buried Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than [**one-sixth of pole height**] [**as indicated**]. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

1. Make holes 6 inch (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days and finish in a dome above finished grade.
3. Use a short piece of 1/2 inch (13 mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

F. Anchor Bolts: Install plumb using manufacturer-supplied [**steel**] [**plywood**] template, uniformly spaced.

3.3 POLE INSTALLATION

A. Alignment: **Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole**.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: **60 inch (1520 mm)**.
2. Water, Gas, Electric, Communications, and Sewer Lines: **10 ft (3 m)**.
3. Trees: 15 ft (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts in accordance with anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level in accordance with pole manufacturer's written instructions.

1. Use anchor bolts and nuts selected to resist seismic forces specified for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers unless otherwise indicated.
4. Use a short piece of 1/2 inch (13 mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6 inch (150 mm) wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 260533.13 "Conduits for Electrical Systems." In concrete foundations, wrap conduit with 0.010 inch (0.254 mm) thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground Nonmetallic Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundation.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by **authorities having jurisdiction**.

B. Tests and Inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.
2. System function tests.

C. Nonconforming Work:

1. Unit will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

E. Manufacturer Services: Engage factory-authorized service representative to **support** field tests and inspections.

1. Manufacturer's Field Reports for Field Quality-Control Support: Prepare and submit report after each visit by factory-authorized service representative, documenting activities performed at Project site.

END OF SECTION 265613

~~SECTION 26 56 00 – EXTERIOR ATHLETIC LIGHTING~~

PART 1– GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of this specification is to define the lighting system performance and design standards for the Perdue Stadium using an LED Lighting source. The manufacturer/contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.

C. The sports lighting will be for the following venues:

1. Perdue Stadium - Baseball Field

E. The primary goals of this sports lighting project are:

1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.

2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors.

3. Cost of Ownership: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.

4. Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.

5. Entertainment Features: Incorporation of theatrical light shows enhance the presentation and enjoyment of players and spectators. Control system shall incorporate pre-programmed light shows such as "chase", “wave”, and “score.” Control system shall incorporate the ability to initiate these shows locally. System shall be able to time light shows to customer-supplied music.

F. All lighting designs shall comply with PDL Lighting Standards.

1.2 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, and Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Baseball Field	100 FC - Infield 70 FC - Outfield	1.2:1 Infield 2.0:1 Outfield	16 Infield 29 Outfield	30' X 30' Infield 60' X 60' Outfield
Bullpens	50 FC	2.0:1	N/A	10' X 10'

B. Color: The lighting system shall have a minimum color temperature of 5,700K and a CRI of 75.

C. Light loss factor shall be a minimum of .88 per PDL standards.

applicable to the immediately adjacent area in fair territory

1.3 Playability

A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.

B. To ensure the underside of the ball has light; a minimum of 575 watts or greater ball tracker fixtures are required at each structure location

C. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified testing laboratory with a minimum of five years experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

PART 2 – PRODUCT

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaries, poles, wire harnesses, drivers, and other enclosures shall be factory-assembled, aimed, wired, and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:

1. Galvanized steel poles and cross-arm assembly.
2. Non-approved pole technology:
    a. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
3. Lighting systems shall use concrete foundations at new pole location. See Section 2.4 for details.
    a. For a foundation using a pre-stressed concrete base embedded in concrete backfill the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
    b. For anchor bolt foundation or foundation using a pre-stressed concrete base in a suspended pier or re-inforced pier design pole erection may occur after 7 days. Or after a concrete sample from the same batch achieves a certain strength.
4. Manufacturer will supply all drivers, cross-arms and supporting electrical equipment
    a. Remote drivers and supporting electrical equipment shall be mounted approximately 10

drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral drivers are not allowed.

b. If remote drivers are not provided for easy access, manufacturer shall provide all new poles with steps/cables/platforms to ensure ease of access.

c. All new cross-arms are to be provided. No exposed wiring at the top of the pole. All wiring to be encased in the new cross-arms

b. The manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode), as recommended by IEEE C62.41.2_2002.

5. Wire harnesses complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

6. All luminaires, visors, and cross-arm assemblies shall withstand 150 mi/h winds and maintain luminaire aiming alignment.

8. Contactor cabinet to provide on-off control.

9. Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

a. Integrated grounding via concrete encased electrode grounding system.

b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
1. Electric power: 480 Volt, 3 Phase
2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

2.4 CONTROL

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

B. Lighting contactor cabinet(s) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

C. Dimming: System shall provide for custom dimming options via DMX control.

D. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.

The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have

E. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if

individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

F. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.

Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.

1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Report hours saved by using early off and push buttons by users.

G. Communication Costs: Manufacturer shall include communication costs for operating the control and monitoring system for a period of 25 years.

H. Communication with luminaire drivers: Control system shall interface with drivers in electrical components enclosures by means of wireless communication.

I. Entertainment Features: Show controller shall provide six (6) preprogrammed light shows per field with option for customized scenes, plus three (4) minutes of custom preprogrammed light shows set to music supplied by customer. Manufacturer-provided user interfaces include touchscreens, push buttons, and/or other external control devices.

2.4 STRUCTURAL PARAMETERS

A. Wind Loads: Wind loads shall be based on the 2015 International Building Code. Wind loads to be calculated using ASCE 7-10, risk category III, an ultimate design wind speed of 130mph and exposure category C.

B. Pole Structural Design: The stress analysis and safety factor of the poles shall conform to 2013 AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-6).

C. Foundation Design: If no geotechnical report is available, the foundation design shall be based on soils that meet or exceed those of a Class 5 material as defined by 2012 IBC Table 1806.2.

D. Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole. These drawings must be submitted at time of bid to allow for accurate pricing.

PART 3 – EXECUTION

3.1 DELIVERY TIMING

A. Delivery Timing Equipment On-Site: The equipment must be on-site 8-12 from receipt of approved submittals and receipt of complete order information.

3.2 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

B. Field Light Level Accountability

1. Light levels are guaranteed not to fall below the target maintained light levels for the entire

2. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

3.4 WARRANTY AND GUARANTEE

A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

PART 4 – DESIGN APPROVAL

4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)

A. Design Approval: The owner / engineer will review pre-bid submittals per section from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.

B. Approved Product: Musco's Light-Structure System™ with TLC for LED™is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.

D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID

All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. ***Submit checklist below with submittal.***

Yes/ No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics d. Height of light test meter above field surface. e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.
	D	Off Field Lighting Design	Lighting design drawing showing initial spill light levels along the boundary line (defined on bid drawings) in foot-candles. Light levels shall be taken at 30-foot intervals along the boundary line. Readings shall be taken with the meter orientation at both horizontal and aimed towards the most intense bank of lights.
	E	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela to Outfield positions and Home Plate
	F	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
	G	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring.
	H	Warranty	Provide written warranty information including all terms and conditions
	I	Project References	Manufacturer to provide a list of 10 projects where the technology for this project has been installed in MiLB baseball. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
	J	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
	K	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
	L	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.

The information supplied herein shall be used for the purpose of complying with the specifications for the Perdue Stadium. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

Manufacturer: _____ **Signature:** _____

Contact Name: _____ **Date:** ____/____/____

Contractor: _____ **Signature:** _____

SECTION 27 05 26

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grounding/Earthing and bonding for Low Voltage systems such as telecommunications and audiovisual systems.

2. Primary Bonding Busbar (PBB)

3. Secondary Bonding Busbar (SBB)

4. Telecommunications Bonding Backbone (TBB)

5. Backbone Bonding Conductor (BBC)

6. Rack Bonding Busbar (RBB)

7. Telecommunications Equipment Bonding Conductor (TEBC)

8. Telecommunications bonding conductor (TBC)

9. Pathways.

B. Related Sections:

1. Division 26 Section *Grounding and Bonding* for building systems with which to interface with Work of this Section.

1.2 DEFINITIONS

A. AFC: Above Finished Ceiling

B. BICSI: Building Industry Consulting Service International.

C. Bonding: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct current.

D. Common Bonding Network (CBN) – The principal means for affecting bonding and earthing inside a building.

E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

F. EMI: Electromagnetic interference.

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G. Ground/Earth – A conducting connection, whether intentional or incidental, by which an electric circuit or equipment is connected to ground, or to some conducting body of relatively large extent that serves in place of the ground.

H. HC: Horizontal Cross Connect

I. IDC: Insulation displacement connector.

J. LAN: Local Area Network.

K. MC: Main Cross-connect

L. NEBS: Network Equipment Building System.

1. NEBS Level 3: Equipment complies with strict specifications for fire suppression, thermal margin testing, vibration resistance including seismic, airflow patterns, acoustic limits, failover and partial operational requirements such as chassis fan failures, failure severity levels, RF emissions and tolerances, and testing/certification requirements.

M. NEC: National Electric Code

N. RCDD: Registered Communications Distribution Designer.

O. TR: Telecommunications Room

P. UTP: Unshielded twisted pair.

1.3 SYSTEM DESCRIPTION

A. Provide a complete and functioning Telecommunications grounding/earthing system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

B. Purpose: Telecommunications grounding/earthing system creates a low impedance path to earth ground to prevent damage to equipment and disruption in service due to electrical surges and transient voltages.

C. Grounding/earthing system comply with following:

1. NEC and local electrical codes

2. ANSI/TIA-607-D or latest version.

3. ISO/IEC 30129

4. IEEE 1100

D. Secondary Bonding Busbar (SBB): Ground/earth each telecommunications space to the Primary Bonding Busbar (PBB) located at the telecommunications entrance room.

1.4 SUBMITTALS

A. Comply with Division 01330 Section *Submittal Procedures*.

B. Submittal data is to be submitted electronically. Each submittal shall contain the below in the following order:

1. Cover Sheet.

a. Include name of supplying contractor and project name.

2. Detailed Bill of Materials.

a. Include a listing of: component quantities, equipment manufacturer, model number, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product. Failure to provide this information will result in the rejection of submittals.

3. Product Data.

a. Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.

C. Shop Drawings

1. Wiring diagram to show grounding schematics, including the following: Busbars and bonding backbone. Detail mounting assemblies and show elevations and physical relationship between the installed components.

2. Show the relationship of TR's, the pathway between them, and cable connectivity to be installed.

3. Drawings should be at project standard scale clearly legible.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements, grounding/earthing and bonding systems:

1. TIA/EIA

a. TIA-942 Telecommunications Infrastructure Standard for Data Centers

b. J-STD-607-D Commercial Building Grounding/Bonding Requirements

c. TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

2. IEEE

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a. Std 1100 IEEE Recommend Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book)

3. Telcordia:

a. NEBS 3 as defined for RBOC-CO compliance.

4. NFPA

a. NFPA-70 National Electric Code (NEC)

B. Testing Procedures:

1. NEBS GR-63-CORE: Network Equipment-Building System Requirements: Physical Protection.

2. NEBS GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety -- Generic Criteria for Network Telecommunications Equipment

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers, Grounding/Earthing Systems:

1. Panduit

2. Chatsworth

3. Harger

4. Burndy

5. Ortronics/Legrand

6. Erico

B. Acceptable Manufacturers, Telecommunications Bonding Busbars:

1. Panduit

2. Chatsworth

3. Harger

4. Burndy

5. Ortronics/Legrand

6. Erico

C. Acceptable Manufacturers, Rack Bonding Kits:

1. Panduit
2. Chatsworth
3. Harger
4. Burndy
5. Ortronics/Legrand
6. Erico

2.2 GROUNDING/EARTHING AND BONDING

A. General:

1. Conductors: Provide copper grounding/earthing conductors.
2. Lugs, grounding strips, and busbars: UL Listed.
3. Fabricate with premium quality tin-plated electrolytic copper, providing low electrical resistance while inhibiting corrosion.
4. Provide antioxidant for field- bonding connections.
5. Lugs: NEBS Level 3. Provide two-hole lugs with irreversible compression and inspection windows, certified for use in non-corrosive environments so that connections may be inspected for full conductor insertion.
6. Die index numbers: Embossed on compression connections to allow crimp inspection.
7. Cable assemblies: UL Listed and CSA Certified.
   a. Cables: Green or green/yellow.
   b. Jackets: UL Listed, VW-1 flame rated.

B. Telecommunications Bonding Backbone (TBB): A cable used to ground/earth PBB. Connect PBB to SBB; comply with J-STD-607-D guidelines and provide gauge not lighter than the following:

C.

Table 1 – TBB/BBC/TBC conductor size vs length	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4 - 6 (14 - 20)	4
6 - 8 (21 - 26)	3
8 - 10 (27 - 33)	2
10 - 13 (34 - 41)	1
13 - 16 (42 - 52)	1/0
16 - 20 (53 - 66)	2/0
20 - 26 (67-84)	3/0

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26 - 32 (85 - 105)	4/0
32 - 38 (106 - 125)	250 kcmil
38 -46 (126 - 150)	300 kcmil
46 - 53 (151 - 175)	350 kcmil
53 - 76 (176 - 250)	500 kcmil
76 - 91 (251 - 300)	600 kcmil
Greater than 91 (301)	750 kcmil

D. Sizing the Telecommunications Bonding Conductor (TBC)

1. The TBC shall be, as a minimum, the same size as the largest TBB.

E. Sizing the Backbone Bonding Conductor (BBC)

1. The BBC shall be, as a minimum, the same size as the largest TBB to which it is connected.

F. Structural metal

1. The bonding conductor from the structural metal to the PBB or SBB shall be sized according to Table 1. Additionally, this conductor should be no smaller than any conductor that comprises the telecommunications bonding backbone system. Bonds to structural metal shall be made using listed exothermic welding, listed compression connections, or listed mechanical connectors and shall be accessible.

G. Telecommunications Equipment Bonding Conductor (TEBC): A cable used from the PBB or SBB to Rack and Rack Bonding Busbar (RBB) – minimum Size 6AWG.

H. Bonding Cable, Typical: For applications other than TBB, TEBC and BBC, provide gauge not lighter than the following:

I.

Table 2- Cable Sizes for Other Grounding/Earthing Applications	
Purpose	Copper Code Cable Size
Aisle grounds (overhead or under floor) of the common bonding network	#2 AWG or larger (1/0 preferred)
Bonding conductor to each PDU or panel board serving the room.	Size per NEC 250.122 & manufacturer recommendations
Bonding conductor to HVAC equipment	6 AWG
Building columns	4 AWG
Cable ladders and trays	6 AWG
Conduit, water pipe, duct	6 AWG

2.3 COMPONENTS, KITS AND HARDWARE

A. Provide BICSI/J-STD-607-D telecommunications Primary Bonding Busbar PBB. Locate PBB at the telecommunications entrance room.

B. Provide BICSI/J-STD-607-D Telecommunications Bonding Conductor (TBC) from the telecommunications entrance room to the AC service entrance. Bonds to AC service entrance shall be made using listed exothermic welding, listed compression connections, or listed mechanical connectors and shall be accessible.

C. Provide BICSI/J-STD-607-D telecommunications Secondary Bonding Busbar (SBB) at typical telecommunications/equipment spaces throughout the building.

1. Provide additional SBB's as needed for number of termination points within each telecommunications/equipment space or upsize the SBB to a PBB.

2. Multiple SBB's within a room shall be bonded together with a conductor the same size as the TBB or with splice bars.

D. Provide BICSI/J-STD-607-D telecommunications Rack Bonding Busbar (RBB) at rack and cabinet locations.

E. Provide compression type two-hole lugs for connecting conductors to PBB, SBB and RBB.

PART 3 - EXECUTION

3.1 ROUTING TBB, TBC AND SBB

A. Route the TBB to each SBB in as straight a path as possible. The TBB should be installed as a continuous conductor, avoiding splices where possible. When more than one TBB is used, bond them together on the top floor and every third floor in-between with a conductor known as a Backbone Bonding Conductor (BBC). When sizing the BBC, it must be at least the same size as the largest TBB.

B. Bend The inside bend radius of telecommunications bonding conductors terminated at the primary bonding busbar (PBB) or secondary bonding busbar (SBB) shall have an inside bend radius of 200 mm (8 in). At other locations, bends in the bonding conductors should be limited to the greatest practical inside bend radius with a minimum bend radius of 10 times the bonding conductor diameter recommended. In all cases, the minimum bend radius angle shall be 90° or greater.

C. Avoid routing grounding/earthing conductors in metal conduits. If the grounding/earthing conductor must be routed through a metal conduit, bond each end of the conduit to the grounding/earthing conductor. Use grounding clamps to bond to the conduit and #6 AWG copper conductor to connect the grounding clamp to the TBB.

3.2 RACK GROUNDING/EARTHING

A. Bonding Equipment and Racks: Comply with BICSI/J-STD-607-D.

B. To provide electrical continuity between rack elements, use paint piercing grounding washers where rack sections bolt together, on both sides, under the head of the bolt, and between the nut and rack.

C. Utilize full-length rack ground strips attached to the rear of the side rail with thread-forming screws provided to ensure metal-to-metal contact.

D. Mount an electrostatic discharge (ESD) port kit, directly to the Rack Bonding Busbar. Mount a second electrostatic discharge (ESD) port kit directly to the vertical mounting rail of the rack in the front at approximately the same height. Use the thread-forming screws provided to form a bond to the rack.

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E. When the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. Use the appropriate jumper for the equipment being installed and the thread-forming screws provided in the kit.

F. Do not bond racks or cabinets serially.

G. Bond patch panels to racks using bonding screws.

H. Patch panels for shielded cabling shall be bonded to the telecommunications bonding system in accordance with manufacturer instructions

3.3 TESTING

A. Perform continuity testing measurements of the grounding system with resistance to not exceed 0.1 ohm between:

1. The PBB and the nearest grounding electrode.

2. Each SBB and the nearest grounding electrode.

3. Each SBB and pathway(s), rack(s), cabinet(s), and applicable equipment.

3.4 GROUNDING SYSTEM

A. Communications grounding system: Comply with ANSI/TIA-942 and ANSI/TIA-607-D.

B. Connection to Building ground/earth: Ensure connection is made by a licensed, electrical Installer, including installation and termination of the main bonding conductor to the building service entrance ground.

C. Bond PBB to building steel; ground/earth to electrical service ground. Comply with BICSI TDM Manual and ANSI/TIA-607-D guidelines.

D. Utilize UL listed exothermic two-hole lugs to make connections to the primary bonding busbar (PBB).

END OF SECTION 27 05 26

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SECTION 27 05 28.48

MULTIMEDIA CONNECTION WALL BOX

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Multimedia Connection Wall Box

B. Related Sections include the following:

1. Division 27 Telecommunications Systems, Audiovisual Systems, wiring, connections, and installation of associated conduit infrastructure

1.2 PERFORMANCE REQUIREMENTS

A. General: Wall boxes provide an interface between power and telecommunication cabling in a wall mount flat panel display locations requiring power and/or communication device outlets.

B. Wall Mounted Connector Assembly: Rubber cable pass thru door and cover assembly along with connector mounting panel inserts

C. Labeling: Wall boxes shall bear the “cULus mark” issued by UL for units complying with both US and Canadian Standards.

D. Standards: Comply with the following:

1. National Electrical Code

1.3 SUBMITTALS

A. Related Sections

1. Comply with requirements of Section 01 33 00, “Submittal Procedures.”

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
   a. Cover Sheet
      1) Include name of supplying contractor and project name.
      2) Include submittal and revision number.
   b. Detailed Bill of Materials
      1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
      2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
      3) Failure to provide this information will result in the rejection of submittals.

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c. Product Data
   1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
   2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
   3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
d. Authorized Distributor Certificate
   1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
e. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.

2. Informational Submittals:
   a. Manufacturer's installation instructions

C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
   a. Title Sheet with sheet index and symbols legend
   b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
   c. All unusual equipment modifications
   d. Equipment location drawings
   e. Detailed riser drawing indicating conduit runs and associated (box knockout) cables within
   f. Floor plans showing Wall box locations based on column grid lines

2. Drawings should be at project standard scale and clearly legible.

3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
   a. Submit all drawings on sheets of one size, preferably the project standard size.
   b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.

2. Product Data and shop drawings must be submitted together in order to be reviewed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. FSR

2. Approved equal

B. Model PWB-100 Wall Box:

1. Box shall be:
   a. Manufactured from 14-gauge steel approved for use in new and renovation construction locations.
   b. Polyester based backed enamel finished interior (white).
   c. Provided with two (2) independent wiring compartments.
   d. Able to work with ½" or 5/8" dry wall.
   e. Box to be able to be installed between 16" on center metal or wood studs.
   f. Able to accept 2-3/4" x 4-1/2" standard size wall plates.

C. Overall box dimensions shall be as follows:

1. 11" W x 5.25" H x 3.57" D.

2.2 COVER

A. PWB-100-WHT - White Cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Installer present, verify that manufacturer's requirements for wall opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify exact locations of Wall box installation.

3.3 INSTALLATION

A. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.

B. Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner, which produces a level box with square, plumb, and straight edges.

C. Telecommunications Cabling Wall box shall have a total of three separate EC with pull string at each box as follows:

1. One 3/4-inch EC from box to circuit panel. (Duplex AC Power)

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2. Two 1-1/4 inch EC from box to telecomm cable tray A.F.C. One conduit run to lower Low voltage backbox and one conduit run to the upper Low voltage backbox.

D. Provide pull strings in each conduit at wall box location.

3.4 ADJUSTING

A. Adjust door and cover for proper operation.

3.5 PROTECTION

A. Protect installed equipment in original undamaged condition until Substantial Completion. Remove and provide new components or units that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 27 05 28.48

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SECTION 27 10 00

TELECOMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. Building Industry Consulting Services International (BiCSi),"Telecommunications Distributions Methods Manual," Fifteenth Edition

B. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) - 568.2-D, "Commercial Building Telecommunications Wiring Standard"

C. ANSI/TIA-569-E, "Commercial Building Standard for Telecommunications Pathways and Spaces"

D. ANSI/TIA-606D, “Administration Standard for the Telecommunications Infrastructure of Commercial Buildings”

E. ANSI/TIA-607-D, “Commercial Building Grounding/Bonding Requirements”

F. National Electrical Code (NEC), 2020 - National Fire Protection Agency (NFPA) 70

G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet 10/100/1000/10000 BASE-T)

H. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68

I. National Institution for Certification in Engineering Technologies (NICET)

J. Audiovisual and Integrated Experience Association (AVIXA).

1.3 SUMMARY

A. Section Includes:

1. UTP cabling

2. Optical fiber cabling

3. Multi-pair copper cable

4. Coaxial cable (radio frequency video)

5. Cable connecting hardware, patch panels, and cross-connects

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6. Telecommunications outlet/connectors

7. Cable management system

8. Cabling identification products

9. Backboards

10. Telecommunications equipment racks and cabinets

11. Telecommunications service entrance pathways

12. Grounding and bonding

13. Telecommunications Pathways

14. Telecommunications mounting elements

B. Related Sections:

1. Division 27 05 26, “Grounding and Bonding for Communications Systems,“ for voice and data cabling associated with system panels and devices

2. Division 27 05 28.36, “Cable Trays for Communications Systems," for voice and data cabling associated with system panels and devices

C. Bidding Requirements:

1. Bidder shall submit complete detailed proposals with line item cost representation for components and associated installation labor. Lump sum bids will not be accepted.

2. Bidders shall include as part of the bid response the following items:
   a. Installation schedule with proposed manpower assignments
   b. Resumes for project manager and lead technician for this project
   c. BICSI RCDD certificate and registration number

3. Bidders shall review associated architectural, electrical, and telecommunications infrastructure drawings to verify that necessary conduit and floor boxes will be provided by others. Bidders shall understand and coordinate shared infrastructure locations for telecommunications outlets. The Owner will provide no additional infrastructure to support the telecommunications cabling systems Inside Plant (ISP) and Outside Plant (OSP). Any discrepancies with the identified infrastructure to support these systems should be questioned in the form of a request for information (RFI) during the bidding process. Be responsible for any additional infrastructure requirements after receipt of contract for this project. No wiremold or surface mounted raceways shall be approved on this project except where specifically identified in the contract drawings.

4. Unspecified Equipment and Material: Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional Structured Cabling System shall be provided in a level of quality consistent with other specified items.

1.4 DEFINITIONS

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A. AFC: Above Finished Ceiling

B. BICSI: Building Industry Consulting Service International

C. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways

D. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection

E. EF: Entrance Facility

F. EMI: Electromagnetic interference

G. HC: Horizontal Cross Connect

H. IDC: Insulation displacement connector

I. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs)

J. LAN: Local Area Network

K. MC: Main Cross-connect

L. MPTL: Modular Plug Terminated Link

M. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors

N. NRTL: Nationally Recognized Testing Laboratory

O. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates

P. RCDD: Registered Communications Distribution Designer

Q. TR: Telecommunications Room

1.5 SYSTEM DESCRIPTION

A. Provide a complete and functioning Structured Cabling System inclusive of all hardware, software, and training to meet or exceed the performance features outlined in this document.

B. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. ANSI/ANSI/TIA-568.2-D requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

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2. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

3. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

4. Bridged taps and splices shall not be installed in the horizontal cabling.

5. Splitters shall not be installed as part of the optical fiber cabling.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

D. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

E. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

F. Communications equipment room shall provide the space to house the equipment for the backbone and horizontal cabling.

1.6 PERFORMANCE REQUIREMENTS:

A. General Performance: The cabling system shall comply with transmission standards in ANSI/TIA-568.2-D and ANSI/TIA-568.3-D when tested according to the test procedures of this standard.

1.7 SUBMITTALS

A. Comply with requirements of Section 01 33 00, “Submittal Procedures.”

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
   a. Cover Sheet
      1) Include name of supplying contractor and project name.
      2) Include submittal and revision number.
   b. Detailed Bill of Materials
      1) Include a listing of component quantities, equipment manufacturers, model numbers, and descriptions of each component being supplied and the specification paragraphs or drawing sheets that correspond to each product.
      2) The bill of materials shall include page numbers for each product data sheet and be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
      3) Failure to provide this information will result in the rejection of submittals.
   c. Product Data

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1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.

d. Authorized Distributor Certificate
1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.

e. Prequalification Warrantee
1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is Authorized to obtain for the owner the Special Warranty for Cabling System and the Special Warranty for System Assurance.

f. Prequalification Certificate
1) Copy of the installing technician(s) certificate of completion from the manufacturer's training school for the equipment being provided.

g. Submittal shall be a single PDF file.
1) Partial submittals, or submittals comprised of multiple PDF files, will be rejected.

C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. Each shop drawing set is to include the below in the following order:
a. Title Sheet
1) Include a list of all drawings in the set and a symbols legend defining each symbol used in the package.

b. Riser Diagram
1) Show the relationship of TR's, the pathway between them, and cable connectivity to be installed.

c. Video/CATV System Engineering
1) Depict device location by room number and device type. Delineate cable types and cable pathway for both riser and horizontal distribution. Calculate db loss and outline levels for each splitter, tap, amplifier, and outlet.

d. Telecommunications Room Details
1) Plan Details of infrastructure and room fittings with clearances
2) Elevation Details of wall fields and rack details showing the relationship of rack mounted elements inclusive of owner-provided equipment (labeled as such).

e. Typical Outlet Details
1) Detail each typical outlet type to be installed. Include manufacturer specific plates, jacks, and an example of labeling. Note on the drawing the typical application of each outlet type, for example; standard office, computer lab, ceiling mounted wireless access location, etc.

f. Floor Plans
1) Show planned location for all elements and cable routing.
2) Include outlet port numbers for each outlet.
3) Cable Schedule: Listing incoming and outgoing cables and their designations, origins, and destinations.

2. Drawings should be at project standard scale and clearly legible.

3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

D. Product data and shop drawings must be submitted together in order to be reviewed.

E. Samples shall be submitted for each typical outlet type to be installed, complete with colored jacks, finished faceplates, and sample labeling.

F. Field quality-control reports

1. Submit copy of project status reporting form.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Level 2 installer and manufactures certified installer, who shall be present at all times when work of this section is performed at project site. At a minimum, one half of remainder of the crew shall be registered technicians by the specified manufacturer as part of their Certified Installer Program.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less

2. Smoke-Developed Index: 50 or less

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Installing company shall be certified by manufactures in aspects of design, installation and testing of optical and Category rated metallic premise distribution systems, be a manufactures Value Added Reseller (VAR) in good standing, have a minimum of five (5) years' experience on similar Structured Cabling Systems (SCS), and have a Registered Communications Distribution Designer (RCDD) on staff.

E. Telecommunications Pathways and Spaces: Comply with ANSI/TIA-569-E.

F. Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, 2017 ANSI/ANSI/TIA–606-C.

G. Grounding: Comply with ANSI-J-STD-607-C.

H. NFPA 70 – National Electric Code, latest edition

I. BICSI – Telecommunications Distribution Methods Manual, Fourteenth Edition

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J. NEMA – VE-1 – Metal Cable Tray Systems, 2017

K. NEMA – VE-2 – Metal Cable Tray Installation Guidelines, 2013

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use an optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

B. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install equipment frames and ladder racking until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.11 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

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C. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

D. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: The greater of one (1) or 10% of total quantity of each type

2. Connecting Blocks: The greater of one (1) or 10% of total quantity of each type

3. Device Plates: The greater of ten (10) or 2% of total quantity of each type

1.13 WARRANTY

A. Special Warranty for Cabling System: Manufactures warranty shall ensure against product defects; that approved cabling components exceed the specifications of ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, and ISO/IEC IS 11801; exceed the attenuation and NEXT requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for cabling links/channels; and that the installation will exceed the loss and bandwidth requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to passive SCS components.

1. Warranty Period: 25 - year Cabling System from date of Substantial Completion

B. Special Warranty for System Assurance: Manufactures warranty shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that recognize ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, or ISO/IEC IS 11801 component and link/channel specifications for cabling.

1. Warranty Period: 25 - year Applications Assurance from date of Substantial Completion

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PATHWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:

1. Basis of design: nVent Caddy

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2. Approved equals by:
   a. Eaton/B-line
   b. Hilti Inc.

B. General Requirements: Comply with ANSI/TIA-569-E.

C. Cable Support: NRTL labeled. Cable support brackets in Telecommunications Rooms shall be designed to prevent degradation of cable performance and pinch points that could damage cable.

D. Provide bend limiters, if not built into the cable support, to maintain cable type bend radius whenever cable exists pathways or makes transition between two pathways.

E. Non-continuous cable supports shall be used in any area above the finished ceiling where cable tray is not available.

F. Adjustable non-continuous cable support slings shall be used in corridors as outlined on the TA series drawings.

G. Bridle rings shall not be used for telecom cable support.

H. Non-continuous cable supports

1. Cable Support shall be NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

2. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.

3. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

4. Non-continuous cable supports sized 1 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

5. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.

6. Non-continuous cable supports shall be NVent CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM, or approved equal.

I. Adjustable non-continuous cable support sling

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 425 4-pair UTP; rated for indoor use in non-corrosive environments. Rated to support Category 5 and higher cable, or optical fiber cable; cULus Listed.

2. Adjustable non-continuous cable support sling shall have a static load limit of 100 lbs.

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3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

4. If required, assemble to manufacturer recommended specialty fasteners including beam clips, flange clips, C and Z purlin clips.

5. Acceptable products: NVENT CADDY CableCat™ CAT425 or approved equal.

J. Multi-tiered non-continuous cable support assemblies

1. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports, rated for indoor use in non-corrosive environments; cULus Listed.

2. If required, the multi-tier support bracket may be assembled to manufacturer recommended specialty fasteners including beam clamps, flange clips, C and Z purlin clips.

3. The multi-tiered support bracket shall consist of NVENT CADDY CATHBA and CableCat™ J-Hooks with screws or approved equal.

K. Non-continuous cable support assemblies from drop wire/ceiling

1. Fastener to wire/rod with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

2. Acceptable products: NVENT CADDY CAT124Z34, CAT126Z34, CAT214Z34, CAT216Z34, CAT324Z34 or CAT326Z34, or approved equal.

L. Non-continuous cable support assemblies from beam, flange

1. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

2. Acceptable products: NVENT CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY beam clamps and CADDY flange clips, or approved equal.

M. Non-continuous cable support assemblies from C & Z Purlin

1. Fastener to C or Z purlin with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus listed.

2. Acceptable products: NVENT CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64 with CADDY Purlin hangers, or approved equal.

N. Non-continuous cable support assemblies from wall, concrete, or joist

1. Fastener to wall, concrete, or joist with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments, cULus listed.

2. Acceptable products: NVENT CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, with CADDY angle bracket, or approved equal.

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O. Non-continuous cable support assemblies from threaded rod

1. Fastener to threaded rod with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments, cULus Listed.

2. The multi-tiered support bracket shall have a static load limit of 300 lbs.

3. U-hooks and Double J-hook shall attach directly to threaded rod using standard nuts.

4. Acceptable products: NVENT CableCatTM J-hook, CAT12, CAT21, CAT32, CAT64 with CADDY CATHBA series; CAT-CMTM Double J-hook CAT100CM, CAT-CMTM Direct mount U-hook CAT200CMLN, CAT300CMLN; or AFAB series, or approved equal.

P. Raised floor non-continuous cable support assemblies

1. Fastener to raised (access) floor pedestal with one non-continuous cable support, factory or jobsite assembled, rated for indoor use in non-corrosive environments; cULus Listed.

2. Acceptable products: NVENT CADDY CAT12CD1B, CAT21CD1B or CAT32CD1B; CAT64CD1B, or approved equal.

Q. Cantilever-Mounted cable supports

1. U-hook shall be able to be assembled to a wide variety of wall mount brackets.

2. Individual U-hooks shall be spaced as needed, maximum 5’ apart.

3. U-hooks may have the optional attachment of a cable roller for ease in pulling cables.

4. Acceptable products: NVENT CAT-CMTM U-hooks CAT200CMLN, CAT300CMLN: CAT-CM roller assemblies CATRL200CM, CATRL300CM; CATWMCM bracket, or approved equal.

2.3 CONDUIT AND BOXES

A. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 5 inches wide, 5 inches high, and 2.875 inches deep.

2.4 UTP CABLE

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Berk-Tek - Leviton

2. CommScope, Inc.

3. Mohawk; a division of Belden CDT

4. Superior Essex Inc.

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5. SYSTIMAX Solutions; a CommScope, Inc. brand
6. Uniprise; a CommScope, Inc. brand
7. Hubbell Premise wire
8. General Cable Technologies Corporation
9. Belden, Inc.
10. Hitachi Cable America Inc.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket

1. Comply with ANSI/TIA-568.2-D for performance specifications.
2. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item. .
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with and NFPA 70 for the following types:
   a. CABLE RATING Choose an item. CABLE RATING

2.5 UTP CABLES - WIRELESS ACCESS POINT

A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article “UTP CABLE”.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket

1. Comply with ANSI/TIA-568.2-D for performance specifications.
2. Comply with ANSI/TIA-568.2-D, Category 6A.
3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with and NFPA 70 for the following types:
   a. CABLE RATING Choose an item. CABLE RATING

2.6 UTP CABLES WET LOCATIONS OR SLAB ON GRADE

A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article “UTP CABLE”.

B. Description: 100-ohm, 4-pair UTP, covered with a thermoplastic jacket.

1. Match color in article “UTP CABLE”.
2. Comply with ICEA S-90-661 for mechanical properties.
3. Comply with ANSI/TIA-568.2-D for performance specifications.

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4. Specifically designed for below-grade conduit or other environments where water is likely to infiltrate.

5. UL Verified for long term water submersion.

6. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item..

7. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NFPA 70 for the following types:
   a. CABLE RATING Choose an item. CABLE RATING

2.7 UTP CABLE HARDWARE

A. Manufacturers Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Hubbell Premise Wiring
2. Leviton Voice & Data Division
3. SYSTIMAX Solutions; a CommScope, Inc. brand
4. Uniprise, a CommScope, Inc. brand
5. Panduit Corp.
6. Siemon Co. (The)
7. Ortronics Corp.
8. Belden, Inc.
9. Hellermann Tyton

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. ADD 110 BLOCKS FOR VOICE Choose an item..

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables

E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.

1. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

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F. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.

1. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item..

2.8 UTP CABLE HARDWARE - WIRELESS ACCESS POINT

A. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article “UTP CABLE HARDWARE”.

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.

1. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.

1. Comply with ANSI/TIA-568.2-D, Category 6A.

2.9 PATCH CORDS

A. Patch Cords: Factory-made, four-pair cables in 3’-20’ in length; terminated with eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure specified category performance. Patch cords shall have latch guards to protect against snagging.

1. TR location: Provide one (1) patch cord to match cable and Jack Assembly category rating per port on the patch panel.

2. Floor outlet locations: Provide one (1) ten foot modular patch cord to match cable and Jack Assembly category rating per eight-position eight conductor modular receptacle.

2.10 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.

1. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item..

B. Workstation Outlets: Provide connector assemblies mounted in single or multigang faceplates as shown on contract drawings.

C. Provide faceplate types to match Division 26 section, “Wiring Devices.”

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1. Plastic Faceplate: High-impact plastic, complying with color requirements in Division 26 Section "Wiring Devices"

2. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices"

3. Wall phone Metal Faceplate: Stainless steel, w/ Studs for Wall Mount Phone outlet.

4. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords

5. Legend: Factory labeled by silk-screening or engraving

6. Legend: Machine printed, in the field, using adhesive-tape label

7. Legend: Snap-in, clear-label covers and machine-printed paper inserts

2.11 TELECOMMUNICATIONS OUTLET/CONNECTORS- WIRELESS ACCESS POINT

A. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.

1. Comply with ANSI/TIA-568.2-D, Category 6A.

B. Workstation Outlets: Provide connector assemblies in two port surface mount box.

1. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords

2. Legend: Snap-in, clear-label covers and machine-printed paper inserts

2.12 RISER COPPER CABLE

A. Description: 100-ohm, PAIR COUNT Choose an item. UTP, formed into 25-pair binder groups covered with a thermoplastic jacket

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with ANSI/TIA-568.2-D for performance specifications.

3. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item..

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with and NFPA 70 for the following types:
   a. CABLE RATING Choose an item. CABLE RATING

2.13 RISER UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by the specified structured cabling solution manufacturer.

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B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568.2-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: CONNECTING BLOCK (Choose an item.). Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

E. Patch Panel: IDC-type for permanent termination of pair groups of installed cables. All patch panels shall be PATCH PANEL (Choose an item.).

1. Terminate riser cable one pair per port on the patch panel.

F. Patch Cords: Factory-made, four-pair cables, 3'-20' in length; terminated with eight-position modular plugs at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to guarantee the specified category performance. Patch cords shall have latch guards to protect against snagging.

1. TR location: Provide one (1) patch cord per port on the patch panel to match the cable and jack assembly category rating.

2.14 RUS PE89 COPPER CABLE

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Superior Essex Inc.

2. SYSTIMAX Solutions; a CommScope Inc. brand

3. General Cable Technologies Corporation

4. Uniprise; a CommScope, Inc. brand

5. Approved equal

B. Description: 100-ohm, PAIR COUNT (Choose an item.) 24 AWG PE89, formed into 25-pair binder groups covered with a Black polyethylene jacket

1. Comply with ICEA S-90-661 for mechanical properties.

2. Comply with ANSI/TIA-568.2-D for performance specifications.

3. Comply with ANSI/TIA-568.2-D, Category 3.

2.15 OUTSIDE PLANT CABLE HARDWARE

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A. Manufacturers: Subject to compliance with requirements, provide products by the specified structured cabling solution manufacturer.

B. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568.2-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 3. Provide blocks for the number of cables terminated on the block, plus 25% percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables

2.16 COPPER CABLE PROTECTION UNITS

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Commscope

2. Cira Telecom

3. Tii Technologies Inc.

4. Approved equal

B. Provide all copper circuits with protection between each building with an entrance cable protector panel.

1. All building-to-building circuits shall be routed through this protector.

2. The protector shall be connected with a #6 AWG copper bonding conductor between the protector ground lug and the EF ground point.

3. The installation shall employ three-element solid state protector modules.

2.17 COPPER SPLICE CASE

A. Copper splice cases as required for OSP splices and transition splice in TR/MC/EF sized to fit splice quantities. Manufactured by Preformed Line Products, 3M or approved equal.

B. Copper splice will be performed in Maintenance Holes only.

C. Splice case filling compound, re-enterable type: 3M 4442 or approved equal

D. Heat Shrink Tubing: Highly Flame Resistant, semi rigid polyvinylidene fluoride (Kynar)

2.18 COAXIAL CABLE

A. Manufacturers: Subject to compliance with the specified requirements, provide products by the following:

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1. CommScope, Inc.

2. Mohawk; a division of Belden CDT

B. Horizontal Cable Characteristics: Broadband type, recommended by the cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 1004 MHz.

1. RG-6/ U
   a. CABLE RATING Choose an item. CABLE RATING
   b. No. 18 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation
   c. Quad shielded with 100 percent aluminum-foil shield and 60 braid, non-bonded tape, 40% Braid, Copolymer jacket
   d. Suitable for indoor installations

C. Riser/Backbone Coaxial Cable: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 1004 MHz.

1. .500/ U
   a. CABLE RATING Choose an item. CABLE RATING
   b. Gauge: 12 AWG solid bare copper, (.500 in)
   c. Outside Diameter: 0.648 in (9.94 mm)
   d. Shields: Duofoil + 63% tinned copper braid
   e. Insulation: Black tint Teflon jacket
   f. Nominal DC Resistance: 8.2 Ω/km
   g. Nominal Mutual Capacitance: 53.5 pF/m @ 1 kHz
   h. Attenuation: 0.5 dB/100 m @ 1 MHz
   i. Characteristic Impedance: 75 Ω @ 1 MHz

D. Outside Building Backbone Coaxial Cable: Outside-building vertical backbone coaxial cable in the new facility supporting video communications requirements shall meet the following technical specifications:

1. .750/U
   a. Gauge: 12 AWG solid bare copper, (.750 in)
   b. Outside Diameter: 0.948 in (12.94 mm)
   c. Shields: Duofoil + 63% tinned copper braid
   d. Insulation: Black tint Teflon jacket
   e. Nominal DC Resistance: 8.2 Ω/km
   f. Nominal Mutual Capacitance: 53.5 pF/m @ 1 kHz
   g. Attenuation: 0.5 dB/100 m @ 1 MHz

2.19 VIDEO SYSTEMS PARTS AND ACCESSORIES

A. Bi-directional Amplifier

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Blonder Tongue BIDA 5800 series
   b. Toner TIBA 37-1000

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c. Approved equal

2. Install in the TR/MC and each TR/HC as needed to complete video system adjusting.

B. Splitters and Taps – Install as needed to complete fully functional CATV distribution system as specified.

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Blonder Tongue SCVS Digital splitters
   b. Toner XGVS Digital splitters
   c. Blonder Tongue SRT Digital taps
   d. Toner TXMT Digital taps
   e. Approved equal

C. F style Connectors to match cable type

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Aim Electronics; a brand of Emerson Electric Co.
   b. Toner Cable Equipment, Inc.
   c. Blonder Tongue Inc.
   d. Approved equal

D. F-type terminators:

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Aim Electronics; a brand of Emerson Electric Co.
   b. Toner Cable Equipment, Inc.
   c. Blonder Tongue Inc.
   d. Approved equal

E. Optical fiber to RF video transcoding electronics

2.20 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, ARE OR ARE NOT Choose an item. limited to, the following:

1. Superior Essex Inc.

2. CommScope, Inc.

3. Corning Cable Systems

4. General Cable Technologies Corporation

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5. Belden, Inc.
6. Mohawk; a division of Belden CDT
7. Optical Cable Corporation
8. Uniprise; a CommScope, Inc. brand
9. SYSTIMAX Solutions; a CommScope Inc. brand
10. Hitachi Cable America Inc.

B. Indoor OM4 Multimode

1. Description: 50/125-micrometer, laser-optimized, 12-strand, nonconductive, tight buffer optical fiber cable
2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with ANSI/TIA-568.3-D for performance specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
   a. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262
   b. Riser Rated, Conductive: Type OFCR, complying with UL 1666
5. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.5 dB/km at 1300 nm
6. Minimum Modal Bandwidth: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm
7. Jacket:
   a. Jacket Color: Aqua
   b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
   c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

C. Outdoor OM4 Multimode

1. Description: 50/125-micrometer, laser-optimized, 12-strand, nonconductive, ribbon optical fiber cable
2. Comply with the following standards for mechanical properties:
   a. Outside plant cable: ICEA S-87-640
   b. Indoor/Outdoor cable: ICEA S-104-696
   c. Aerial, duct, and buried outdoor cable: ICEA S-110-717
   d. Indoor/Outdoor drop applications: ICEA S-110-717
3. Comply with ANSI/TIA-568.3-D for performance specifications.
4. Comply with ANSI/TIA-492AAAA-A for detailed specifications.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:

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a. CABLE RATING AND NON or NON CONDUCTIVE Choose an item.

6. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.5 dB/km at 1300 nm

7. Minimum Modal Bandwidth: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm

8. Jacket:
   a. Jacket Color: Purple
   b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
   c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

9. Conductive cable shall be steel armored type.

10. Non- conductive cable shall be dielectric armored type.

D. Indoor OS2 Singlemode

1. Description: 12-strand fiber, nonconductive, tight bufferoptical fiber cable

2. Comply with ICEA S-83-596 for mechanical properties.

3. Comply with ANSI/TIA-568.3-D for performance specifications.

4. Comply with ANSI/TIA-492-CAAA for detailed specifications.

5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
   a. CABLE RATING AND NON or NON CONDUCTIVE Choose an item.

6. Maximum Attenuation: 0.3 dB/km at 1550 nm

7. Jacket:
   a. Jacket Color: Yellow
   b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
   c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

8. Conductive cable shall be steel armored type.

9. Non- conductive cable shall be dielectric armored type.

E. Outdoor OS2 Singlemode

1. Description: 12-strand fiber, nonconductive, ribbonoptical fiber cable

2. Comply with the following standards for mechanical properties:
   a. Outside plant cable: ICEA S-87-640
   b. Indoor/Outdoor cable: ICEA S-104-696
   c. Aerial, duct, and buried outdoor cable: ICEA S-110-717
   d. Indoor/Outdoor drop applications: ICEA S-110-717

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3. Comply with ANSI/TIA-568.3-D for performance specifications.

4. Comply with ANSI/TIA-492-CAAA for detailed specifications.

5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
   a. CABLE RATING AND NON or NON CONDUCTIVE Choose an item.

6. Maximum Attenuation: 0.3 dB/km at 1550 nm

7. Jacket:
   a. Jacket Color: Black
   b. Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
   c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

8. Conductive cable shall be steel [or aluminum] armored type.

9. Non- conductive cable shall be dielectric armored type.

2.21 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Hubbell Premise Wiring.

2. Leviton Voice & Data Division.

3. CommScope, Inc.

4. Panduit Corp.

5. Siemon Co. (The)

6. Belden, Inc.

7. Ortronics Corp.

8. Corning Cable Systems

9. Optical Cable Corporation (OCC)

10. Hellermann Tyton

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, simplex and duplex cable connectors

1. Number of Connectors per Field: Provide one for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit the specified expansion criteria.

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2. Fiber optic enclosures shall be rack-mountable with accommodations for splice trays.

3. Fiber optic enclosures shall be wall-mountable with accommodations for splice trays.

4. Install fusion splice trays as needed for transition points and factory terminated pigtails.

5. LC duplex 12-fiber coupler panels shall be used for multimode fiber.

6. LC duplex 12-fiber coupler panels shall be used for singlemode fiber.

7. Size fiber enclosure for 25% percent spare capacity.

C. Patch Cords: Provide factory-made, dual-fiber cables in one (1) meter lengths. Supply LC duplex for one-half of the total termination points.

D. Patch Cords: Provide factory-made, dual-fiber cables in three (3) meter lengths. Supply LC duplex for one-half of the total termination points.

E. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of ANSI/TIA-604-2, ANSI/TIA-604-3-A, and ANSI/TIA-604-12. Comply with ANSI/TIA-568.3-D.

2. Multimode connector type: LC

3. Singlemode connector type: LC

4. Connectors for multimode and singlemode shall be field installed via fusion splicing.

F. Wall mounted optical fiber slack loop holder

1. Leviton 12" wire management ring 48900-IFR

2. Leviton 24" wire management ring 48900-OFR
   a. Place on wall to manage slack one for each fiber type

2.22 OPTICAL FIBER CABLE SPLICE

A. Fiber splice shall be placed in a cabinet with tray quantities for total fusion splices for transition splice in TR. Manufactured by Corning or approved equal.

2.23 INNERDUCT

A. OSP applications:

1. Description: Standard Outdoor Textile Innerduct, 3-inch, 3-cell, polyester and nylon resin polymer textile innerduct with factory-installed flat woven pull tape. Manufactured by MaxCell or approved equal.

2. Fittings:
   a. Conduit Plugs: Use compression-type conduit plugs with locking nuts to seal and secure one or more textile innerducts within 4” conduits.

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b. Termination Bags: Use inflation-type bags to seal and secure one or more textile innerducts within 2” or larger conduit.

B. Indoor applications:

1. Description: Indoor, Riser-rated, 3-cell, nylon textile innerduct, Orange or White in color, with factory installed pull tape. Manufactured by MaxCell or approved equal.

2. Fittings:
   a. Conduit Plugs: Use compression-type conduit plugs with locking nuts to seal and secure one or more textile innerducts within 4” conduits.
   b. Termination Bags: Use inflation-type bags to seal and secure one or more textile innerducts within 2” or larger conduit.

C. OSP applications:

1. Description: Corrugated High Density Polyethylene (HDPE) 1 ¼ inch Orange in color with factory installed pull tape. Manufactured by Carlon or approved equal.

2. Splices shall only be at Maintenance Hole locations if necessary. No splices shall be allowed in conduit.

3. Use PIC1 Nonmetallic internal coupling to join sections as needed.

D. Indoor applications:

1. Description: DUCT RATING (Choose an item.) -gard 1 ¼ inch Orange or White in color with factory installed pull tape. Manufactured by Carlon or approved equal.

2. Splices shall only be in SEF or TR/MC/HC locations if necessary. No splices shall be allowed in conduit.

3. Use manufacturer approved nonmetallic internal coupling to join sections.

4. Use manufacturer approved nonmetallic internal coupling to join sections.

2.24 CABLE LUBRICANT

A. Cable pulling lubricant shall be utilized when pulling cable.

B. Product:

1. Ideal

2. Polywater

3. or approved equal

2.25 FIRE STOP CABLE PASS-THRU SLEEVES

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A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Basis of design: Specified Technologies Inc.

2. Approved equal by:
   a. 3M Corporation
   b. Hilti CFS-MSL Modular Sleeve
   c. Hilti Speed Sleeve
   d. Wiremold- Legrand Corporation

B. Fire Rated Cable Pathways: STI EZ-PATH Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH Series 44 Fire Rated Pathway

2. Specified Technologies Inc. (STI) EZ-PATH Series 33 Fire Rated Pathway

C. EZ-path series 44 wall sleeves shall be provided for all telecom room penetrations to cable distribution system.

D. Horizontal cable pathway locations greater than 20 cables fire stop sleeves shall be STI EZ-Path series 33.

E. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with UL listed system for firestopping is acceptable. Caulks and sealants shall be as manufactured by STI, Hilti, 3M, Nelson, or approved equivalent.

F. Fill ratio for fire stop EMT sleeves shall not exceed 20% fill capacity.

2.26 FIRE STOP CABLE MODULAR FLOOR GRID SYSTEM

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Basis of design: Specified Technologies Inc.

2. Approved equal by:
   a. Hilti Corporation
   b. 3M Corporation

B. Fire stop sleeves located in the floor of TR’s shall be STI EZ PATH Series 44 Modular Grid. Provide sleeves for all Telecom Room floor penetrations. Fill ratio shall not exceed 20% fill capacity.

1. Product: EZDG444 single slot grid complete with EZ-PATH Series 44 modules

2. Product: EZG844 with EZD444MB pathway modules.

3. Product: EZG1644 with EZD444MB pathway modules

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2.27 NON-RATED CABLE PASS-THRU SLEEVES

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Basis of design: Specified Technologies Inc.

2. Approved equal by:
   a. 3M Corporation
   b. Hilti Smoke and Acoustic Sleeve
   c. Wiremold- Legrand Corporation

B. Non-Rated Cable Pathways: STI EZ-PATH Brand device modules The smoke and acoustical pathway shall contain a built-in sealing system and shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall acoustical materials. The following products are acceptable:

1. Specified Technologies Inc. (STI) EZ Path® Series 44 NEZ Smoke and Acoustical Pathway

2. Specified Technologies Inc. (STI) EZ Path® Series 33 NEZ Smoke and Acoustical Pathway

3. SpecSeal® Smoke ‘N’ Sound Smoke and Acoustical Sealant
   a. SNS120W 20 Oz Sausage - 36 cu in (592 ml)
   b. SNS129W 730573111529 29 Oz Tube - 52 cu in (858 ml)
   c. SNS105W 730573111543 5 Gallon Pail - 1,155 cu in (19.0 L) (White)

C. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with mineral or ceramic fiber stuffing insulation and smoke/acoustical Sealant.

D. Fill ratio for fire stop EMT sleeves shall not exceed 20% fill capacity.

2.28 GROUNDING

A. Comply with requirements in Division 27 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-C.

2.29 LADDER RACK, SUPPORTS, AND ACCESSORIES

A. Ladder Rack (Universal Cable Runway)

1. Ladder rack shall be manufactured from 3/8” wide by 1-1/2” high tubular steel with .065” wall thickness.

2. Ladder rack (side stringers) will be 9’-11½” long. Cross members will be welded in between stringers on 12” centers beginning 5-3/4” from one end so that there are 10 cross members per ladder rack. There will be 10-1/2” of open space in between each cross member.

3. Ladder rack will be delivered individually boxed, and available in the multiple widths.

4. Finish shall be epoxy-polyester hybrid powder coat (paint) black in color.

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5. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-712, Universal Cable Runway, 12” Wide, Black or approved equal

6. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-718, Universal Cable Runway, 18” Wide, Black or approved equal

7. Product: Chatsworths Products, Inc. (CPI), Universal Cable Runway: Part Number 10250-724, Universal Cable Runway, 24” Wide, Black placed in vertical positions or approved equal

B. Ladder Rack Splices

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless steel hardware.

3. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.

4. Finish (of splice plates and hardware) shall be zinc plate in the color(s) specified below. Colors are applied as a chem. film over the zinc plate.

5. Product: Chatsworths Products, Inc. (CPI), Cable Runway Splices or approved equal

C. Ladder Rack Supports

1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will work with all widths of ladder rack.

2. Each support will include a means of securing ladder rack to the support.

3. Supports will be manufactured from steel or aluminum.

4. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below or zinc plate with a gold chem. finish specified gold. Included hardware shall be zinc plated with a gold chem. finish.

5. Product: Chatsworths Products, Inc. (CPI), Cable Runway Supports or approved equal

D. Ladder Rack Accessories

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least ¾” wide, and sized for cable bundles that are 2”, 3” or 4” in diameter.

2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack shall be manufactured from 1” by ½” tubular steel with .065” wall thickness. Cable retaining posts

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will be 8” high and will attach to the side stringer of the ladder rack with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.

3. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8” wide by 1-1/2” high side stingers and will be sold in pairs.

4. End closing kits used to cover the end of ladder rack will be manufactured from 3/8” wide by 1-1/2” high tubular steel with .065” wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.

5. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3”. Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2” high cable spools that attach to the top of the radius drop to guide cables.

6. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8” by 1-1/2” aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.

7. Cable spools used to separate ladder rack into multiple cable pathways will be made from a black flame retardant ABS. Cable spools will attach to the cross members with a clip that allows the width of the ladder rack to be divided into any proportion. The spools will be 3.94” tall, with a 1.94” diameter top, and a body that tapers from .88” (diameter) at the top to .62” (diameter) at the bottom.

8. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack will be made from 1/8” x 1” steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack. The bracket will hang below the ladder rack a minimum of 4”. The bracket support surface will be 4” long. The bracket will be zinc plated with a gold chem. finish.

9. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.

10. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) black in color. Hardware will be zinc plated with a gold chem. finish.

11. Product: Chatsworths Products, Inc. (CPI), Cable Runway Accessories or approved equal

2.30 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches A-C Grade

1. Provide materials that comply with performance requirements in AWPA C27. Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

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2. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5516, for plywood.

B. All 4 walls shall be covered with rigidly fixed 3/4 inch A-C plywood with the A grade side facing outward. The plywood shall be void free and extend from 6 inches above the finished floor (AFF) to 102 inches AFF and capable of supporting the attached equipment.

C. Comply with requirements in Division 09 Section “Paints and Coatings" for fire-retardant plywood.

2.31 EQUIPMENT FRAMES

A. Free Standing Relay Racks

1. Racks shall be manufactured from aluminum and/or steel extrusions.

2. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with bolt hardware. Equipment-mounting channels will be threaded for easy assembly. The base angles will be pre-punched for attachment to the floor.

3. Equipment mounting channels will be 3” deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.

4. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The rack will include assembly and equipment-mounting hardware. Each rack will include 50 each combination pan head, pilot point mounting screws.

5. The rack will be rated for 1,500 lb. of equipment.

6. The rack will be UL Listed.

7. Finish shall be epoxy-polyester hybrid powder coat black in color.

8. Product: Chatsworths Products, Inc. (CPI), Universal Self-Support Rack or approved equal

2.32 CABLE MANAGEMENT

A. Vertical Cable Management for Racks

1. Every rack will have a minimum of one vertical cable manager. The vertical cable manager will create a space for storing and organizing cables along the side of the rack/frame. The cable manager will maintain separation between patch/equipment/jumper cords and premise cables. The last rack in a row shall have two vertical cable managers.

2. The cable manager will be sized to match cabling requirements and to fit the rack/frame or as specified. The initial quantity of cables within the cable manager will not exceed a whole number value equal to 40% of the interior area of the cable manager.

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3. A single vertical cable manager can be used in between bayed racks/frames if it is sized to match cable requirements for both racks/frames. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.

4. The vertical cable manager will match the height of the rack(s)/frame(s).

5. The vertical cable manager will bolt to the side of racks/frames with included hardware. The manufacturer of the vertical cable manager will sell compatible racks/frames.

6. The vertical cable manager will be a double-sided H-shaped trough with front and rear covers. The double-sided trough will provide independent front and rear cable pathways and will have multiple evenly-spaced edge-protected front-to-rear cable pass-through holes for cables in the center divider.

7. The front and rear covers will be removable, hinged to open from the right or left side and will include a latch that will secure the cover in the closed position.

8. The vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each .25” OD patch cords.

9. The cable manager will be delivered individually boxed, and available in several widths as specified below and in the contract documents.

10. The vertical cable manager shall be manufactured from sheet aluminum and composite materials.

11. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.

12. Product: Chatsworths Products, Inc. (CPI): CCS MCS Master Cabling Section: Part Number Part Number 30095-703, MCS Master Cabling Section, Double-Sided, 6” Wide x 84” High x 16.15”D, Black or approved equal

13. Product: Chatsworths Products, Inc. (CPI): CCS MCS Master Cabling Section: Part Number Part Number 30096-703, MCS Master Cabling Section, Double-Sided, 10” Wide x 84” High x 16.15”D, Black or approved equal

B. Horizontal Cable Management for Racks, Frames or Cabinets

1. Place horizontal cable managers above and below each patch panel in each rack/cabinet. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.

2. Provide 2 RMU of horizontal cable management above and below every patch panel. Cables must be able to access the cable manager so that no ports are blocked by the cables.

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3. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.

4. The horizontal cable manager will match the rack-mount width of the racks/cabinets.

5. The horizontal cable manager will attach to the front or rear of the rack/frame/cabinet with screws and will be sized to fit within standard EIA-310-D (1-3/4" high RMU) rack-mount spacing. The manufacturer of the horizontal cable manager will sell compatible racks/cabinets.

6. The horizontal cable manager will be a single-sided C-shaped trough with a cover. The single-sided trough will have a slot or holes at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager will have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides will allow cables to enter/exit the cable manager into the rack-mount space. The openings will have rounded edges to protect cables. The cover will be removable, hinged to open up or down and will snap on to secure the cover in the closed position.

7. The horizontal cable manager will be delivered individually boxed, and available in several widths and heights as specified below and in the contract documents.

8. The horizontal cable manager shall be manufactured from sheet aluminum and composite materials.

9. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.

10. Product: Chatsworths Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30130-719, Universal Horizontal Cable Manager, Single-Sided, 19" Wide x 2 RMU x 5" Deep, Black or approved equal

11. Product: Chatsworths Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30139-719, Universal Horizontal Cable Manager, Single-Sided, 19" Wide x 1 RMU x 5" Deep, Black or approved equal

2.33 POWER DISTRIBUTION UNIT (PDU)

A. Vertical

1. Product Feature:
   a. Monitoring Power - Local (Amps, Volts, Watts, Power Factor)
   b. Digital RMS Scrolling Power Meter +/- 2% Accuracy with Full Scale 60Hz sine wave input.
   c. Voltage 100-120V, Current 20A
   d. On/off switch
   e. Power Cable Length 10ft
   f. Plug Type NEMA 5-20P
   g. Receptacle Type NEMA 5-20R - twenty (20) each
   h. Heavy Steel - Powder Coat Finish Black
   i. Configuration - 66in Vertical Rack/Cabinet mount

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2.34 UNINTERRUPTIBLE POWER SUPPLY

A. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Chatsworths Products, Inc. (CPI)

2. MinuteMan

3. TrippLite

4. American Power Company (APC)

5. Cyber Power

6. Approved equal

B. Each equipment rack shall contain a rack mounted local uninterruptible power supply (UPS).

C. The UPS shall be able to support its' associated rack enclosure in an active state of operation for not less than thirty-minutes.

2.35 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Electrical Identification."

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

B. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

C. Install pathways complying with recommendations in ANSI/TIA-569-E, "Entrance Facilities" Article.

1. Install entrance pathway complying with Division 26 Section "Raceways and Boxes."

3.2 INSTALLATION OF PATHWAYS

A. Comply with ANSI/TIA-569-E for pull-box sizing and length of conduit and number of bends between pull points.

1. Pull boxes:

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a. Provide pull boxes as required to ensure that no section of conduit exceeds 100' between accessible pull points.
b. No section of conduit shall have greater than two 90-degree bends or a cumulative 180 degrees of total bends.
c. Pull boxes shall be placed in straight sections of conduit and shall not be used in place of a bend.
d. Pull boxes should be readily accessible and shall be sized per the BICSI TDMM.

2. Conduit bends:
   a. The inside bend radius for conduit sized 2" or less shall be minimum six times the internal conduit diameter.
   b. The inside bend radius for conduit larger than 2" shall be minimum ten times the internal conduit diameter.

B. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.

4. Extend conduits 3 inches (76 mm) above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.3 NON-CONTINUOUS CABLE SUPPORTS

A. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ /TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

B. Do not exceed load ratings specified by manufacturer.

C. Adjustable non-continuous support sling shall have a static load limit of 100 lbs.

D. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

E. Bridle rings shall not be used for telecom cable support.

3.4 WIRING METHODS

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A. Wiring Method: Install cables in raceways, J hooks, and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables accessible ceilings, walls, and floors except in unfinished spaces.

B. Install plenum cable in environmental air spaces, including plenum ceilings.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

E. Provide equipment frames and ladder racking as outlined in telecommunications series drawings.

3.5 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Cables shall not be painted or exposed to any other building adhesives, paint, coatings, or other foreign agents.

7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

11. In the communications equipment room, install a 10-foot long service loop on each end of cable.

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12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with ANSI/TIA-568.2-D.

2. Do not untwist UTP cables more than 1/4 inch from the point of termination to maintain cable geometry.

3. Terminate patch panels and outlets to a pin/pair assignment as directed by owner.

D. UTP Riser Cable Installation:

1. Comply with ANSI/TIA-568.2-D.

2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

3. Terminate patch panels to a pin/pair assignment as directed by owner.

E. UTP Patch Cords

1. Provide modular cords required to connect LAN switches to modular jacks on cross connect panel shall be furnished as part of this solicitation. Quantities should be equal to the total number of network outlets. At the Patch panel location provide patch cable lengths as needed for a neat installation utilizing vertical wire managers. At the user outlets provide 10 foot patch cables for each 8 pin modular connector

F. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. The telecom structured cable shall be supported by its own independent support system.

4. Plastic “zip-ties” shall not be used. Cables shall be bundled utilizing plenum rated hook and loop type cable ties.

G. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 10 feet long not less than 12 inches in diameter below each feed point.

H. Group connecting hardware for cables into separate logical fields.

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I. Optical Fiber Cable Installation:

1. Comply with ANSI/TIA-568.3-D.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

3. Fiber shall be installed in innerduct within conduits.

4. Fiber shall be installed in innerduct within buildings.

5. Multiple fibers shall be pulled in the same innerduct whenever possible.

6. Fiber shall be installed in one continuous piece.

7. Any excess fiber shall be coiled neatly and secured to a wall above the plywood backboard so it is out of the way of normal traffic and is not subject to unusual flexing.

J. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.

2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

K. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: minimum 5 inches
   b. Electrical Equipment Rating between 2 and 5 kVA: minimum 12 inches
   c. Electrical Equipment Rating More Than 5 kVA: minimum 24 inches

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: minimum 2-1/2 inches
   b. Electrical Equipment Rating between 2 and 5 kVA: minimum 6 inches
   c. Electrical Equipment Rating More Than 5 kVA: minimum 12 inches

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement
   b. Electrical Equipment Rating between 2 and 5 kVA: minimum 3 inches
   c. Electrical Equipment Rating More Than 5 kVA: minimum 6 inches

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: minimum 48 inches

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6. Separation between Communications Cables and Fluorescent Fixtures: minimum 5 inches

3.6 INSTALLATION OF INNERDUCT

A. Textile innerduct shall be installed as follows:

1. In a clear 4-inch conduit, two (2) each 3” 3-cell with additional pull tape outside innerducts for future pulls.

2. Install per manufacturer’s instructions.

3. Provide suitable slack in maintenance holes, hand holes, pull boxes, and at turns to ensure there is no kinking or binding of the product.

4. When exposed indoors or in maintenance holes, hold firmly in place using independent supports.

B. Standard Innerduct shall be installed as follows:

1. In a clear 4-inch conduit, provide three (3) each 1 ¼” innerduct.

2. In ducts with other cables, as many as possible without damaging the existing cables.

3.7 INSTALLATION TELECOMMUNICATIONS ROOMS

A. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

B. Bond the shield of any shielded cable to the grounding busbar in communications rooms and spaces.

C. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

D. Free Standing Relay Racks

1. Assemble relay racks according to manufacturer’s instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below. (Use CPI Part Number 40604-003 for concrete slab floors.)

3. Racks shall be grounded to the TGB using appropriate hardware. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).

4. Ladder rack shall be attached to the top of the racks/cabinets to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.

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5. The equipment load should be evenly distributed and uniform on the rack/cabinets. Place large and heavy equipment towards the bottom of the racks/cabinets. Secure all equipment to the racks/cabinets with equipment mounting screws.

E. Ladder Rack

1. Provide all components of the ladder rack system (ladder rack, turns, splices, supports, and accessories) from a single manufacturer.

2. Ladder rack shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

3. Ladder rack shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

4. Ladder rack splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.

5. Ladder rack shall be supported every 5' or less in accordance with TIA-569-E. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.

6. Heavy-duty splices are recommended for ladder rack in excess of 18" width (18" wide ladder rack). Heavy-duty splices are required for any splice formed in the vertical orientation including changes in elevation formed using vertical-to-horizontal 90° turns or horizontal-to-vertical 90° turns. Use heavy-duty splices to secure all overhead turns to the overhead horizontal pathway(s).

7. When the pathway is overhead, ladder rack shall be installed with a minimum clearance of 12" above the ladder rack. Leave a minimum of 12" in between ladder rack and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack shall be installed with a minimum clearance of 12" in between each tier of ladder rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack.

8. When installed under a raised floor, ladder rack shall be installed with a minimum 3" clearance between the top of the ladder rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks wherever ladder racks cross.

9. Within each telecommunications room, ladder rack should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack and turns shall be bonded across each splice with a bonding kit. Ladder rack shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack and ground lug. Use antioxidant

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joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB.

10. The quantity of cables within the ladder rack will not exceed a whole number value equal to 50% of the interior area of the ladder rack divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2”, unless cable retaining posts are added to the ladder rack. The interior area of ladder rack equipped with cable retaining posts will be considered to be the width of the ladder rack multiplied by a height of 6”. Actual cable fill for ladder rack that is not equipped with cable retaining posts will not exceed 2” in height. Actual cable fill for ladder rack equipped with cable retaining posts will not exceed 6” in height.

11. The combined weight of cables within the ladder rack will not exceed the stated load capacity of the ladder rack as stated in the manufacturer’s product specifications or load/design tables.

12. Cables (cable bundles) will be secured to the cross members of ladder rack with ¾” wide reusable straps. Straps are not required when ladder rack is equipped with cable retaining posts.

13. Add 8” high cable retaining posts to the open sides of ladder rack when cable fill exceeds 2” in height or when cable bundles cannot be secured directly to the ladder rack cross members with a strap. Cable fill within any ladder rack should not exceed 6” in height.

14. When a single ladder rack supports different types of cable media, the cable media will be separated within the pathway by cable spools that attach to the cross members on the ladder rack. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.

15. Use a radius drop to guide cables wherever cable exits overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field. If necessary, provide a moveable cross member also to attach and align the radius drop in between the welded cross members of a ladder rack.

16. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.

17. Use auxiliary support brackets that attach to the side stringer of the ladder rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the ladder rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the ladder rack as defined by local code or the authority having jurisdiction (AHJ).

18. Whenever possible, maintain a 2’ separation between ladder rack used for communications cables and pathways for other utilities or building services.

19. Provide touch-up paint color-matched to the finish on the ladder rack and correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically

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damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

F. Vertical Cable Managers

1. Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.

2. When a single vertical cable manager is used in between two racks, attach the vertical cable manager to both racks.

3. When more than one cable manager is used on a rack or group of racks, use the same make, style and size of vertical cable manager on the rack or in between racks.

4. The color of the racks and cable managers must match.

5. Doors should be attached to the cable manager and in the closed position after cabling is complete.

G. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack/cabinet or group of racks/cabinets, use the same make, and style of cable manager on the rack/cabinet or racks/cabinets.

2. The color of the racks and cable managers must match.

3. Attach horizontal cable managers to the rack/cabinet with four screws according to the manufacturer's installation instructions. Each cable manager should be centered within the allocated rack-mount space (RMU).

4. Horizontal managers will be located so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable manager.

5. Covers should be attached to the cable manager and in the closed position after cabling is complete.

3.8 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

C. Install EZ Path floor grid system for all Telecommunications Room floor penetrations with additional quantity as shown on contract drawings.

D. Install EZ Path Series 44 modules for all Telecommunications Room wall penetrations with additional quantity as shown on contract drawings.

E. Install EZ Path or EMT sleeve where horizontal cables penetrate a fire rated wall.

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F. Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of firestopping products.

G. Comply with ANSI/TIA-569-E, "Firestopping."

H. Comply with BICSI TDMM, "Firestopping Systems" Article.

I. Any penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be fire-stopped.

3.9 NON-RATED CABLE PASS-THRU SLEEVES

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. General: Install through-penetration systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

C. EZ Path® Series 44 NEZ Smoke and Acoustical Pathway per manufactures instructions

D. EZ Path® Series 33NEZ Smoke and Acoustical Pathway per manufactures instructions

E. Any EMT non-rated wall penetrations created for the passage of telecommunications shall have the annular space filled with mineral wool and Smoke and sound acoustical sealant.

F. Any non-rated EMT wall penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be filled with mineral or ceramic fiber stuffing insulation and smoke/sound acoustical sealant.

3.10 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with requirements in division 27 05 26 “Grounding and Bonding for Communications Systems” for grounding conductors and connectors.

C. Comply with ANSI-J-STD-607-C.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.11 VIDEO SYSTEM INSTALLATION - BUILDING INTERIOR

A. Install a completely functional, bi-directional RF Broadband video systems with self-terminating video outlets a built-in 75-Ohm resistor and a connector-actuated switch that automatically terminates the line when a cable connector is removed.

B. Measure, confirm, adjust and test the available signal strength to +20 (in db value) in the main RF distribution amplifier or splitter output port located in the new MC Room.

C. Adjust amplifier gain and make other system adjustments to achieve specified output levels (+3-6db range) at each outlet. Provide riser drawing with db loss calculations for approval prior to any RF video cable installation.

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D. Install Bi-directional Amplifier in the TR/MC and each TR/HC as needed to complete video system adjusting.

E. Install Splitters and taps in each TR as needed to complete fully functional CATV distribution system as specified.

F. The RG-6 station cable shall be supported every sixty (60) inches, and clearly indicate the jack and room number of the station end in indelible ink written on plastic cable tags attached to both ends of the cable.

G. Connectors shall be chosen and installed so they can withstand thirty (30) pounds of pulling force without separating from the cable.

H. Install Multichannel RF Fiber Optic AM Transmitter in the MC of the building location that is to be furnished by owner.

I. Install Multichannel RF Fiber Optic AM Receiver in the MC of the project building.

3.12 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C.

B. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

C. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

D. Cable Schedule: Post in prominent location in each equipment room and Telecommunications Room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an AutoCad or Revit and PDF electronic copy of final comprehensive schedules for Project.

E. Cable Schedule Spreadsheet: Provide sorted by each equipment room and Telecommunications Room. List incoming and outgoing cables and their designations, origins, and destinations. Furnish in Microsoft Excel final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for Telecommunications Rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish Autodesk Revit and PDF – project version -electronic record of all drawings.

G. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

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3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.

4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Exposed Riser Cables in j-hooks, Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.

I. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.13 SOURCE QUALITY CONTROL

A. Factory test UTP and optical fiber cables on reels according to ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

B. Factory test UTP cables according to ANSI/TIA-568.2-D.

C. Factory test multimode and singlemode optical fiber cables according to ANSI/TIA-526-14-A and ANSI/TIA-568.3-D.

D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.14 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP, multi-pair copper and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

2. Visually confirm cable category marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

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4. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.2D. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.3-D. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to ANSI/TIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA-568.3-D.
   c. Optical Time Domain Reflectometer (OTDR) Tests:
      1) Provide OTDR testing for all installed optical fiber links, including all backbone and horizontal links.
      2) Submit OTDR test results to owner upon completion of system installation.

6. UTP Performance Tests:
   a. Test for each outlet and MUTOA. Perform the following tests according to ANSI/TIA-568.2-D:
      1) Wire map.
      2) Length (physical vs. electrical, and length requirements).
      3) Insertion loss.
      4) Near-end crosstalk (NEXT) loss.
      5) Power sum near-end crosstalk (PSNEXT) loss.
      6) Equal-level far-end crosstalk (ELFEXT).
      7) Power sum equal-level far-end crosstalk (PSELFEXT).
      8) Return loss.
      9) Propagation delay.
      10) Delay skew.

7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to ANSI/TIA-568.3-D.

8. Coaxial Cable and Video Signal Performance Tests: Perform coaxial testing according to ANSI/TIA-568.4-D. Tests shall be performed in the following manner to verify correct installation of coaxial cable and video system electronics:
   a. Input Signal @ 450 MHz Output Output @ chi. 7
   b. (after pad & equalizer) @450 MHz (175.2 MHz) +6 dBmv (+/- 1 dbmv) +40 dBmv after amplifier (+/- 5dbmv)
   c. The output of directional couplers and FFTs shall be at least +9 dBmv.

9. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
   a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and

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receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.

b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

3.15 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

3.16 REPAIR/RESTORATION

A. Protect adjacent surfaces. Repair damage to any surfaces occurring as a result of the work of this section. Repair of surfaces shall include re-painting in accordance with Division 09 section “Painting.”

3.17 CLEANING

A. At the completion of the system, restore aspects of the project site to its former condition. Remove daily waste and excess materials, rubbish debris, tools and equipment resulting from or used in the services provided under this contract. Remove trash from all work areas. Do not use dumpsters or trash disposal without prior approval.

END OF SECTION 27 10 00

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SECTION 27 41 00

AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. 11 52 13 – Projection Screens

C. 27 05 28.48 – Multimedia Connection Wall Box

D. 27 05 28.50 – Multimedia Flush Poke-Thru Device

E. 27 41 13 – Multimedia Floorbox

F. 27 05 26 – Grounding and Bonding for Communications Systems

G. Audiovisual (AV) System Drawings

H. Other Drawings

1. Related Architectural Drawings; for reference only.

2. Related Electrical Drawings; for reference only.

1.2 REFERENCES

A. Building Industry Consulting Services International (BiCSi),"Telecommunications Distributions Methods Manual," Fifteenth Edition.

B. American National Standards Institute/Telecommunications Industry Association (ANSI/TIA) - 568.2-D, "Commercial Building Telecommunications Wiring Standard"

C. ANSI/TIA-569-E, "Commercial Building Standard for Telecommunications Pathways and Spaces"

D. EIA/TIA-606D, “Administration Standard for the Telecommunications Infrastructure of Commercial Buildings”

E. EIA/TIA-607-D, “Commercial Building Grounding/Bonding Requirements”

F. National Electrical Code (NEC), 2020 - National Fire Protection Agency (NFPA) 70

G. Institute of Electrical and Electronic Engineers (IEEE) 802.3 Carrier Sense Multiple Access with Collision Detection (Ethernet 10/100/1000/10000 BASE-T)

H. Federal Communications Commission (FCC), Title 47, Code of Federal Regulations, Part 68.

I. National Institution for Certification in Engineering Technologies (NICET)

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J. Audiovisual and Integrated Experience Association (AVIXA).

1.3 DEFINITIONS

A. ADA: Americans with Disabilities Act

B. ALS: Assistive Listening System

C. AV: Audiovisual

D. AVIXA: Audiovisual and Integrated Experience Association

E. BICSI: Building Industry Consulting Service International

F. Bid: Herein, used interchangeably with “proposal”

G. CATV: Central or Master Antenna Television (broadband)

H. DSP: Digital Signal Processor

I. IR: Infrared

J. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.

K. OFE: “Owner Furnished Equipment” which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.

L. OFCI: “Owner Furnished Contractor Installed” Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.

M. RCDD: Registered Communications Distribution Designer

N. RF: Radio Frequency

O. The term “shall” is mandatory.

P. The term “will” is informative.

Q. The term “should” is advisory.

R. Term “provide” means furnish and install.

S. AV Consultant: Convergent Technologies Design Group, Inc.

T. Bidder: Qualified firm intending to tender a bid on the systems described herein.

U. Construction Manager (CM) or General Contractor (GC): The representative responsible for general building construction and onsite coordination between sub-contractors

1.4 BID PROPOSALS

A. Itemized Bid Response

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1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity on a per room basis. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.

2. Non-equipment charges shall be outlined separately as a single line item on a per room basis. A sum of the audiovisual system total cost shall be provided with the bid proposal.

3. Be responsible for all equipment and installation as indicated in the construction documents. Any equipment omissions or modifications in the itemized bid response shall not serve as direction to omit or modify project scope without explicit written agreement from the owner, architect, and AV consultant.

B. Contractor Qualification

1. Demonstrate at least three (3) years' experience in fabrication, programming, assembly, and installation of audiovisual presentation and remote-control systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
   a. The AV contractors own forces, at a minimum, are to perform the AV system Programming.

2. References: Furnish no less than three (3) references for installations of similar size (dollar amount & quantity of spaces receiving integrated technology) and scope, performed within the past three (3) years. At a minimum, reference information will include the reference company or institute name, contact person's name and title, telephone number, address, and detailed project description, project manager's name, and contact information of the organization that is responsible for day-to-day operation of the audiovisual installation.

3. Programming shall be completed by contractors' own staff.

C. Alternate Proposals

1. Any proposed alternate equipment choices should be requested in writing prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.

D. Non-Equipment Charges, including but not limited to:

1. Engineering: Including all required design drawings, run sheets, instruction manuals, console layout, step-by-step user guide, etc.

2. Pre-Installation: Work performed on the Installer's premises including all fabrication, modification, assembly, rack wiring, etc.

3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner's premises.

4. General and Administrative: Including all shipping, insurance, and guarantees.

E. Owner Furnished Equipment (OFE, OFCI)

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1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the AV systems installation.

F. State of the Art Development

1. Supply only the manufacturer's latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.

2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, Propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.

3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
   a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
   b. Equipment defect or intended recall shall not relieve the AV Contractor from any contractual obligations with regard to delivery schedule of product.
   c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.

G. Service Contract

1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost and can be accepted at the option of the Owner.

2. The service contract shall include all services provided during the warranty period, including complete replacement or repair of defective equipment.

1.5 QUALITY ASSURANCE

A. Coordination

1. Coordinate this Section with work of other Project Manual sections and associated trades.

2. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.

B. Standards and Codes

1. Comply with
   a. Local, state and federal codes
   b. Applicable National Electrical Code
   c. American National Standards Institute
   d. Underwriters' Laboratories, Inc. standards.

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2. All equipment, material, accessories, and loose items provided shall be new and shall conform to applicable requirements of the above-mentioned agencies.

3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

C. Point of Contact

1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.

2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

1.6 SCOPE OF WORK

A. Provide the following in accordance with Specifications and Drawings:

1. Submittals delivered in a timely manner as described hereinafter.

2. Verification of dimensions and other conditions at project site. Review Conduit System as shown in building Construction Documents and, where applicable, as-built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit/infrastructure system design. Review Telecommunications Structured Cabling System to ensure sufficient network connections are provided to support the Audiovisual Systems.

3. Review all AV equipment mounting and rack enclosures to verify dimensions, power provisions, and ventilation. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in equipment rack enclosures and mounting locations.

4. Detailed design of Digital Signal Processor system "maps," including remote-control accommodations.

5. Complete programming of audiovisual remote-control system inclusive of graphical layout and source code programming
   a. Programming shall be completed by contractors' own staff.

6. Power distribution within equipment racks including power connection to electrical outlets as described in the electrical sections of the building construction documents.

7. Incidentals necessary for a complete working system.

8. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.

9. Record Documents, "As-Built" drawings and Owner's Manual.

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10. Training of operating personnel.

11. Notify appropriate parties of conflicts in a timely manner.

12. Work cooperatively with other trades to resolve conflicts.

B. Special Insurance

1. Provide insurance fully covering all equipment against loss and damage during shipment, storage, installation, testing, adjustment and demonstration.

1.7 SYSTEM DESCRIPTION

A. Design Intent

1. Provide a complete and functioning audiovisual (AV) system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

B. Design Standards

1. The Owner's goal is to have available a cohesive and fully functional system. Therefore, part of the development efforts for successfully implementing the AV systems should include:
   a. Install the system in a manner that complies with BiCSi and AVIXA cable routing standards. Route all audio, video, and control cabling elements in a subtle, unobtrusive manner to maintain the architectural and visual integrity of the building.
   b. Except where plenum cable is used above finished ceilings, it is required that all cabling be routed inside the comprehensive system of conduit. Floor and wall boxes shall serve as the primary interface points to the AV system.
   c. Provide and install cover plates, connectors, and associated cabling to link all floor and wall boxes to all affiliated local and remote AV components. No wiremold or surface-mounted raceway will be permitted unless explicitly specified. Coordinate faceplate materials, colors, and finishes with the faceplates used by other trades on the project and the architect to match aesthetics.
   d. Provide and install security covers on any electronics with front panel controls that should not need to be adjusted after initial set-up. All components permanently mounted to rack rail systems shall be installed with industry accepted security screws.
   e. All ceiling mounted AV equipment shall be secured to building structure.
   f. No more than thirty lamp hours shall be expired for projection system set-up at the time of final systems acceptance. Should more hours than this be expired, replace the lamp at no cost to the Owner.
   g. Steel cable security systems and padlocks to secure structure shall be provided for all surface-mounted loudspeakers, document cameras, video cameras, flat panel displays, and projectors. All padlocks provided for security shall be keyed to a single master key.
   h. Provide an intellectual property release and install an editable version of all master source code for all digital signal processing, remote control or microprocessor-based systems included on this project to an owner furnished personal computer. Also provide a hardcopy on portable media.
   i. Provide necessary audio, video, RGBHV, HDMI, DVI, USB, and control signal repeaters, extenders, and amplifiers for any run greater than 30 feet and as needed to maintain required signal levels for receipt at destination device. All audio lines shall be balanced at the source, prior to any cable pull longer than 20 feet. There are no exceptions.

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j. Video camera locations shall receive AC power from associated equipment rack low voltage transformers within 60 feet.
k. For each input/output point of interface to the system, provide a suitable length patch cord for owner use for every signal type present. Provide umbilical style cable management for any mobile solutions.

2. Performance Standards: Unless restricted by the published specifications of a particular piece of equipment, or unless otherwise required, the following minimum performance standards shall be met by each system:
   a. Analog Audio:
      1) S/N (including crosstalk and hum): 75 dB minimum
      2) Total Harmonic Distortion: 0.5% maximum from 30 Hz to 15,00Hz.
      3) Frequency Response: Flat within +1.0 dB, 30 Hz to 15,000Hz.
   b. Analog Video:
      1) S/N (peak to RMS) unweighted DC to 4.2 MHz: 45-dB minimum
      2) Crosstalk, unweighted DC to 4.2 MHz: 45 dB minimum
      3) Frequency Response(composite): Within +0.5 dB to 10 MHz
      4) Frequency Response(component): Within +0.5 dB to 100 MHz
      5) Line and Field Tilt: 2% maximum
      6) Differential Gain: 3% maximum
      7) Differential Phase: 2 degrees maximum
   c. Digital Visual Interface (DVI):
      1) TMDS Channel Pixel Clock: Support up to 165 MHz
      2) EDID: Support DDC
   d. High Definition Multimedia Interface (HDMI):
      1) TMDS Channel Pixel Clock: Support up to 340 MHz
      2) Bandwidth for 1080p signals: Support Deep Color and 3D
      3) Bandwidth for 4k signals: Support HDR, 60fps, 4:4:4
      4) EDID and CEC: Supported
   e. AV Over IP
      1) H.264: Support up to 1080p/60
      2) H.265: Support up to 4K/60, 4:2:2
      3) M.JPEG: Support up to 4K/60, 4:4:4
      4) Other proprietary codecs: Support minimum 1080p/60
      5) The latency for all in-room sources visible within a given space shall not exceed 30ms.
   f. Network Audio:
      1) Dante: minimum 48kHz, 24-bit, 64i/64o
      2) AVB: minimum 48kHz, 24-bit, 64i/64o
   g. Performance Test Signal Paths: The signal paths for the above Performance Standards shall be as follows:
      1) Audio: From any and all source inputs (for microphones, computers, wireless presentation gateways, etc.) through all audio processing, preamplifiers, audio distribution amplifiers (ADA), mixers, switchers, codecs, encoders, decoders, etc., to all electrical signal destinations.
      2) Video: From all source inputs (for cameras, computers, wireless presentation gateways, etc.) through all distribution amplifiers (VDA), processors, switchers, matrices, encoders, decoders, transmitters, scalers, etc., to all signal destinations.
   h. Remote-Control Standards: As a minimum, the remote-control system for each space shall be programmed to include the following:
      1) Owner Logo on first page.
      2) Automatic System Shutdown.
      3) AM/PM Clock Settings.
      4) 50% or other reasonable audio level default.

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5) Separate Program and Microphone Audio Level Control with mute function.
6) Volume/Mute controls for program and speech audio reinforcement on every screen.
7) Panel layout to include user screens with separate, password protected technician pages.
8) Raise and lower the projection screen when projection is powered off/on, respectively.
9) Assign the room computer as default system source upon power up.
10) Activate a minimum of three (3) presets for each installed remote-controllable video camera.
11) Provide remote-control room management software and full licensing for each system on the project.
12) Full function control of all source components, display units, processing devices and switching electronics.
13) In sub-dividable spaces, provide both IR and closed contact partition sensor control, and automation of control system scenarios. Provide an additional option for manual override within a password-protected technician page.
14) Touch panel page layouts shall be submitted for approval. Prior to designing touch panel layouts, meet with the Owner to review existing control system standards on campus and determine a basis of design.
15) Follow-up programming and modifications as requested by the Owner shall be provided 6 months after system acceptance. Provide and install updated editable source code to the Owner following these updates.
16) In the event the remote-control system programming becomes compromised during the warranty period, provide the necessary effort to make the system fully functional once again.

C. Category Rated Cabling

1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

2. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.8 SUBMITTALS

A. Related Sections

1. Comply with requirements of Section 01 33 00, “Submittal Procedures.”

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
   a. Cover Sheet
      1) Include name of supplying contractor and project name.
      2) Include submittal and revision number.
   b. Detailed Bill of Materials

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1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.
2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
3) Failure to provide this information will result in the rejection of submittals.

c. Product Data
1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.

d. Authorized Distributor Certificate
1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.

e. Prequalification Warrantee - Category Rated Cabling
1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is Authorized to obtain for the owner the Special Warranty for Cabling System and the Special Warranty for System Assurance.

f. Submittal shall be a single PDF file.
1) Partial submittals, or submittals comprised of multiple PDF files, will be rejected.

C. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
a. Title Sheet with sheet index and symbols legend
1) Include a list of all drawings in the set and a symbols legend defining each symbol used in the package.
b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
c. All equipment racks, cabinets, consoles, tables, carts, support bases, and shelves
d. Schematic drawings (AV & Control Signal Flows), system functional block drawings, including those for audio and video subsystems
e. All unusual equipment modifications
f. Equipment rack elevations
g. Equipment location drawings
h. Dimensions for all AV equipment racks and enclosures, verifying adequate space, power, and ventilation are provided
i. Cable labeling plan
j. Floor Plans, RCPs and Elevations:
1) Show planned location for all elements and cable routing.
2) Indicate projector distance, throw ratio, and lens.
3) For any inductive loop assisted listening systems, indicate the inductive loop pathway.

2. Drawings should be at project standard scale and clearly legible.

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3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

D. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
   a. Submit all drawings on sheets of one size, preferably the project standard size.
   b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.

2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following submittals shall not be considered partial:
   a. Personnel
   b. Milestones
   c. Conduit Verification Statement and Notifications
   d. Rigging and Mounting Drawings
   e. As-Built Documentation

3. Product Data and shop drawings must be submitted together in order to be reviewed.

E. User Interface

1. In order to develop a user interface which is both functional and useable, provide working "Beta" copies of system software for review and comment by the owner, architect and the AV consultant as per the below listed schedule:
   a. This is anticipated to be an interactive process, requiring at least three submittals prior to first beneficial use. At a minimum, the software development process will have the following milestones:
      1) Initial concept submittal for review
      2) First Beta Review
      3) Second Beta Review
      4) Final implementation and onsite training: Prior to final acceptance
      5) Follow-up programming review and updates: within sixty-days from final acceptance

F. Weekly Reporting

1. Commencing with project award, provide weekly status reporting of milestone task status, anticipated completion date, and related memo notes for the following tasks:
   a. Submittals
   b. Infrastructure verification
   c. Pre-wire status
   d. Equipment Procurement
   e. Shop fabrication
   f. Remote control system design
   g. Installation and Terminations
   h. Field testing and pre-acceptance testing
   i. Final acceptance demonstrations
   j. Owner training
   k. First owner use
   l. Open Coordination Items and Questions

2. See below for a partial example of an acceptable weekly reporting list.

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Project: *Project Name*							
Location: *Project Location*					Date: *Form Delivery Date*		
Project Manager: *Project Manager*					Delivered by: *Form Delivered By*		
		Projected Completion:		Status:		Notes:	
Infrastructure Verification:		*6/1/2018*		*Complete*			
Submittals:							
	Product Data	*8/1/2018*		*Complete*			
	Drawings	*8/1/2018*		*Complete*			
	Personnel (etc.)	*8/1/2018*		*Complete*			
RFIs:							
	12	*8/25/2018*		*Received*		*Implementing*	
	178	*9/6/2018*		*Pending*		*Projector Screen Clearances*	

Installation Status by Space

Room			Equipment				
Name	Number	Pre-Wire	Order	Receive	Install	Test	Notes:
Example 1	*105*	*100%*	*100%*	*100%*	*60%*	*0%*	*Re-programming*
Example 2	*135*	*100%*	*100%*	*100%*	*90%*	*0%*	*Other Notes Here*

G. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
   a. Project Manager
   b. Lead Systems Engineer
   c. Field Foreman
   d. Remote Control System Programmer

H. Conduit Verification

1. Within four weeks after award of Contract, submit statement confirming that the conduit system as designed in building construction documents has reviewed and, where applicable, as built.

2. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.

3. Absent conduit verification and after installation of conduit as designed, assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

1.9 CLOSEOUT SUBMITTALS

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A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following, in compliance with Division 1 Section *Closeout Procedures*.

1. Operation and Maintenance Manuals:
   a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
   b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system and provide the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" user's guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.

2. Warranty
   a. Provide list and dates of activation of equipment warranties.
   b. Provide original manufacturers' certificates.

3. As-built Drawings
   a. Include contractor-generated digital record diagrams for all systems including, but not limited to:
      1) Schematic wiring diagrams with cable markings
      2) Internal wiring diagrams of the equipment rack cabinets
      3) Custom equipment modifications
      4) Final test results and nominal settings for all adjustable controls
   b. Resubmittal or markup of contract documents will not be accepted.

4. AV Passwords and Security
   a. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of audio/video equipment, the software for which is password-protected)
   b. Provide to Owner's Representative as a secure document, separate from Operations and Maintenance Manuals and As-Built Drawings.
   c. IP address schedule for all network-addressable AV devices

5. Editable Control System Code
   a. Provide the final control system code in an editable format.

6. Laminated Instruction Cards
   a. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for each room that has an AV system. Provide editable file of card to Owner.

1.10 IDENTIFICATION CATEGORY RATED CABLING

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-C. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

B. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA-606-C. Furnish AutoCad - latest version -electronic record of all drawings.

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1.11 DELIVERY, STORAGE, HANDLING, AND STAGING

A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.

B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Offsite pre-staging of goods is encouraged.

C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.

D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.

E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by Construction Manager. Time required from delivery date to completion of project shall be in accordance with the approved schedules.

1.12 SYSTEM TRAINING

A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media, and make training videos available to the owner at no charge. The training shall be organized as follows:

1. Two (2) two-hour training classes for system technical operation and maintenance. This class shall cover the following topics:
   a. Review of signal flow diagrams
   b. Review of all equipment functions, relevant to the function in this system
   c. Review of initial equipment settings
   d. Demonstration of all functional connections from a user perspective
   e. Review & demonstration of replacement procedures for consumables (e.g., lamps)
   f. Review of manufacturers' recommended routine maintenance procedures

2. Two (2) two-hour training classes for system engineering concerns. This class shall cover the following topics:
   a. Review of signal flow diagrams
   b. Review of all equipment functions, relevant to the installation
   c. Review of initial equipment settings
   d. Review of manufacturer's recommended routine maintenance procedures
   e. Review & demonstration of replacement procedures for consumables (e.g., lamps)
   f. Review & demonstration of control system software replacement/upgrade procedures

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3. Two (2) four-hour training classes addressing AV system operations. The classes will demonstrate and describe the following:
   a. System set-up and operations
   b. Control system operation
   c. How to attach microphones, record AV signals, and control the sound system
   d. Videoconferencing operation & capabilities (if applicable)
   e. Audio monitoring and ADA system operations
   f. Cable antenna television system (CATV)

4. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.

5. Closeout submittals shall be provided prior to any training classes.

6. Coordinate detailed specifics of the training session(s) time, date, and location with the Owner.

1.13 WARRANTY

A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.

B. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.

C. Coordinate and provide updates to the control system code & touch panel layouts based on owner feedback of desired functionality during warranty period.

D. Provide a total of eight (8) one-day visits per year, or a total of sixty-four (64) engineering/ service labor hours to conduct preventive maintenance and the Owner directed system adjustments.

E. Each visit will include:

1. Cleaning optical lenses

2. Checking and replacing projection lamps filters and indicators

3. Checking and repairing microphones and microphone cables

4. Conducting subjective and objective tests of the audio, video, and control systems of the installed audiovisual systems

F. Repair and adjust any malfunctioning components located by the technician during this testing. Include control system programming updates and modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.

G. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.

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H. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.

I. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.

J. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

K. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

1.14 WARRANTY CATEGORY RATED CABLING

A. Special Warranty for Cabling System: Manufactures warranty shall ensure against product defects; that approved cabling components exceed the specifications of ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, and ISO/IEC IS 11801; exceed the attenuation and NEXT requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for cabling links/channels; and that the installation will exceed the loss and bandwidth requirements of ANSI/TIA-TSB-67 and ISO/IEC IS 11801 for fiber links/channels. The warranty shall apply to passive SCS components.

1. Warranty Period: 25 - year Cabling System from date of Substantial Completion

B. Special Warranty for System Assurance: Manufactures warranty shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that recognize ANSI/TIA-568.2-D, ANSI/TIA-568.3-D, or ISO/IEC IS 11801 component and link/channel specifications for cabling.

1. Warranty Period: 25 - year Applications Assurance from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:

1. Basis of design: ERICO

2. Approved equals by:
   a. Eaton/B-line
   b. Hilti Inc.

B. General Requirements: Comply with ANSI/TIA-569-E.

C. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable.

D. Provide bend limiters, if not built into the cable support, to maintain cable type bend radius whenever cable exists pathways or makes transition between two pathways.

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E. Bridle rings shall not be used for cable support.

F. Non-continuous cable supports

1. Cable Support shall be NRTL labeled for support of Category Rated cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

2. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables; cULus Listed.

3. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

4. Non-continuous cable supports sized 1 5/16” and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

5. Non-continuous cable supports shall have an electro-galvanized or G60 finish and shall be rated for indoor use in non-corrosive environments.

6. Fastener to beam or flange with one non-continuous cable support, factory or jobsite assembled; rated for indoor use in non-corrosive environments; cULus Listed.

7. Support accessories:
   a. Fastener to C or Z purlin
   b. Fastener to threaded rod
   c. Fastener to wire
   d. Beam clamps

8. Non-continuous cable supports shall be ERICO CableCatTM J-hook series CAT12, CAT21, CAT32, CAT64, CAT21SS, CAT32SS, CAT64SS; CAT-CMTM Double J-Hook CAT100CM; CAT-CMTM U-hook series CAT200CMLN, CAT300CMLN; and CAT-CMTM retainer CATRT200CM, CATRT300CM, or approved equal.

2.2 POWER DISTRIBUTION UNITS (PDU)

A. Each AV equipment cabinet is to contain a rack mounted power distribution panel (PDU).

1. Horizontal: For rack/cabinet less than 42U. PDU to occupy the first rack space in each rack/cabinet.
   a. Product Feature:
      1) Two (2) pull out LED lights
      2) Digital voltmeter/ammeter, with discrete dimmer button, displays line voltage and RMS current draw
      3) Isolated outlet banks minimize inter-component interference and noise contamination
      4) 20A rating with a high inrush magnetic circuit breaker
      5) Minimum of Nine (9) outlets (eight (8) rear panel outlets and one (1) front panel convenience outlet)
      6) Plug type NEMA 5-20P, Receptacle Type NEMA 5-20R
      7) Heavy Steel - Powder Coat Finish Black

2. Vertical: For rack/cabinet equal to or greater than 42U.
   a. Product Feature:

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1) Monitoring Power - Local (Amps, Volts, Watts, Power Factor)
2) Digital RMS Scrolling Power Meter +/- 2% Accuracy with Full Scale 60Hz sine wave input
3) Voltage 100-120V, Current 20A
4) On/off switch
5) Power Cable Length 10ft
6) Plug Type NEMA 5-20P
7) Receptacle Type NEMA 5-20R - twenty (20) each
8) Heavy Steel - Powder Coat Finish Black
9) Configuration - 66in Vertical Rack/Cabinet mount

2.3 F/UTP AND UTP CABLE AND CABLE HARDWARE

A. Manufacturers

1. F/UTP AND UTP Cable and Cable Hardware to be the same manufacturer as Section 27 10 00 Communication construction standards.

B. F/UTP Cable

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Crestron
   b. Extron
   c. Berk-Tek; Leviton
   d. CommScope, Inc.
   e. Superior Essex Inc.
   f. Uniprise; a CommScope, Inc. brand
   g. Hubbell Premise wire
   h. General Cable Technologies Corporation
   i. Belden, Inc.
   j. Hitachi Cable America Inc.
   k. Approved equal

2. Description: 100-ohm, 4-pair F/UTP with overall foil shield, covered with a blue thermoplastic jacket
   a. Comply with ICEA S-90-661 for mechanical properties.
   b. Comply with TIA/EIA-568.2-D for performance specifications.
   c. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item.).
   d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   e. Choose an item.

C. UTP Cable

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Berk-Tek; a Nexans company
   b. CommScope, Inc.
   c. Superior Essex Inc.
   d. Uniprise; a CommScope, Inc. brand
   e. Hubbell Premise wire

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f. General Cable Technologies Corporation
g. Belden, Inc.
h. Hitachi Cable America Inc.
i. Approved equal

2. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket
   a. Comply with ICEA S-90-661 for mechanical properties.
   b. Comply with ANSI/TIA-568.2-D for performance specifications.
   c. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY Choose an item..
   d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      1) CABLE RATING Choose an item. CABLE RATING

D. UTP Cables Wet Locations Or Slab On Grade

1. Manufacturers: Subject to compliance with requirements, provide cable product by the specified UTP cable manufacturer article “UTP CABLE”.

2. Description: 100-ohm, 4-pair UTP, covered with a thermoplastic jacket.
   a. Match color in article “UTP CABLE”.
   b. Comply with ICEA S-90-661 for mechanical properties.
   c. Comply with ANSI/TIA-568.2-D for performance specifications.
   d. Specifically designed for below-grade conduit or other environments where water is likely to infiltrate.
   e. UL Verified for long term water submersion.
   f. Comply with ANSI/TIA-568.2-D, Category Choose an item..
   g. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      1) CABLE RATING Choose an item. CABLE RATING

E. F/UTP Cable Hardware

1. Manufacturers Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Crestron
   b. Extron
   c. Hubbell Premise Wiring
   d. Leviton Voice & Data Division
   e. Uniprise, a CommScope, Inc. brand
   f. Panduit Corp.
   g. Ortronics Corp.
   h. Belden, Inc.
   i. Approved equal

2. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

3. Shielded Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.

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a. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

4. Shielded Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
   a. Comply with ANSI/TIA-568.2-D, Category Choose an item..

5. Shielded Patch Cords: Factory-made, four-pair cables in 3'-20' in length; terminated with eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure specified category performance. Patch cords shall have latch guards to protect against snagging.
   a. TR location: Provide one (1) patch cord to match cable and Jack Assembly category rating per port on the patch panel.
   b. Floor outlet locations: Provide one (1) ten foot modular patch cord to match cable and Jack Assembly category rating per eight-position eight conductor modular receptacle.

F. UTP Cable Hardware

1. Manufacturers Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Hubbell Premise Wiring
   b. Leviton Voice & Data Division
   c. Uniprise, a CommScope, Inc. brand
   d. Panduit Corp.
   e. Ortronics Corp.
   f. Belden, Inc.
   g. Approved equal

2. General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA-568-D, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

3. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. All patch panels shall be 48-port.
   a. Number of Jacks per Field: Provide one for each four-pair UTP cable indicated conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

4. Jacks and Jack Assemblies: Modular, color-coded, eight-position, eight conductor, modular receptacle units with integral IDC-type terminals.
   a. Comply with ANSI/TIA-568.2-D, Category CABLE CATEGORY (Choose an item.).

5. Patch Cords: Factory-made, four-pair cables in 3'-20' in length; terminated with eight-position modular plug at each end. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure specified category performance. Patch cords shall have latch guards to protect against snagging.
   a. TR location: Provide one (1) patch cord to match cable and Jack Assembly category rating per port on the patch panel.
   b. Floor outlet locations: Provide one (1) ten foot modular patch cord to match cable and Jack Assembly category rating per eight-position eight conductor modular receptacle.

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G. Telecommunications Outlet/Connectors

1. Device Outlets: Provide connector assemblies mounted in single or multigang faceplates as shown on contract drawings.

2. Provide faceplate types to match Division 26 section, “Wiring Devices.”
   a. Plastic Faceplate: High-impact plastic, complying with color requirements in Division 26 Section "Wiring Devices"
   b. Metal Faceplate: Stainless steel, complying with requirements in Division 26 Section "Wiring Devices"
   c. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords
   d. Legend: Factory labeled by silk-screening or engraving
   e. Legend: Machine printed, in the field, using adhesive-tape label
   f. Legend: Snap-in, clear-label covers and machine-printed paper inserts

2.4 OPTICAL FIBER CABLE AND CABLE HARDWARE

A. Manufacturers

1. Optical Fiber Cable and Cable Hardware to be the same manufacturer as Section 27 10 00 Communication construction standards.

B. Optical Fiber Cable

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Superior Essex Inc.
   b. CommScope, Inc.
   c. Corning Cable Systems
   d. General Cable Technologies Corporation
   e. Belden, Inc.
   f. Optical Cable Corporation
   g. Uniprise; a CommScope, Inc. brand
   h. Approved equal

2. Indoor OM4 Multimode
   a. Description: 50/125-micrometer, laser-optimized, 12-strand, nonconductive, tight bufferoptical fiber cable
   b. Comply with ICEA S-83-596 for mechanical properties.
   c. Comply with ANSI/TIA-568.3-D for performance specifications.
   d. Comply with ANSI/TIA-492AAAA-A for detailed specifications.
   e. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      1) CABLE RATING AND NON or NON CONDUCTIVE Choose an item.
   f. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.5 dB/km at 1300 nm
   g. Minimum Modal Bandwidth: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm
   h. Jacket:
      1) Jacket Color: Purple
      2) Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
      3) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

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3. Indoor OS2 Singlemode
   a. Description: 12-strand fiber, nonconductive, tight bufferoptical fiber cable
   b. Comply with ICEA S-83-596 for mechanical properties.
   c. Comply with ANSI/TIA-568.3-D for performance specifications.
   d. Comply with ANSI/TIA-492-CAAA for detailed specifications.
   e. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      1) CABLE RATING AND NON or NON CONDUCTIVE Choose an item.
   f. Maximum Attenuation: 0.3 dB/km at 1550 nm
   g. Jacket:
      1) Jacket Color: Yellow
      2) Cable cordage jacket, fiber, unit, and group color shall comply with ANSI/TIA-598-B.
      3) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
   h. Non- conductive cable shall be dielectric armored type.

C. Optical Fiber Cable Hardware

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   a. Hubbell Premise Wiring.
   b. Leviton Voice & Data Division.
   c. Panduit Corp.
   d. Belden, Inc.
   e. Ortronics Corp.
   f. Corning Cable Systems
   g. Approved equal

2. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, simplex and duplex cable connectors
   a. Number of Connectors per Field: Provide one for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit the specified expansion criteria.
   b. Fiber optic enclosures shall be rack-mountable with accommodations for splice trays.
   c. Fiber optic enclosures shall be wall-mountable with accommodations for splice trays.
   d. Install fusion splice trays as needed for transition points and factory terminated pigtails.
   e. LC duplex 12-fiber coupler panels shall be used for multimode fiber.
   f. LC duplex 12-fiber coupler panels shall be used for singlemode fiber.
   g. Size fiber enclosure for 25% percent spare capacity.

3. Patch Cords: Provide factory-made, dual-fiber cables in one (1) meter lengths. Supply LC duplex for one-half of the total termination points.

4. Patch Cords: Provide factory-made, dual-fiber cables in three (3) meter lengths. Supply LC duplex for one-half of the total termination points.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of ANSI/TIA-604-2, ANSI/TIA-604-3-A, and ANSI/TIA-604-12. Comply with ANSI/TIA-568.3-D.

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a. Multimode connector type: LC
b. Singlemode connector type: LC

2. Connectors for multimode and singlemode shall be field installed via fusion splicing.

2.5 CABLE PASS-THRU SLEEVES

A. Fire Stop Cable Pass-Thru Sleeves

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

2. Basis of design: Specified Technologies Inc.

3. Approved equal by:
a. 3M Corporation
b. Hilti CFS-MSL Modular Sleeve
c. Hilti Speed Sleeve
d. Wiremold- Legrand Corporation

4. Fire Rated Cable Pathways: STI EZ-PATH Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. The following products are acceptable:

5. Specified Technologies Inc. (STI) EZ-PATH Series 44 Fire Rated Pathway

6. Specified Technologies Inc. (STI) EZ-PATH Series 33 Fire Rated Pathway

7. EZ-path series 44 wall sleeves shall be provided for all telecom room penetrations to cable distribution system.

8. Horizontal cable pathway locations greater than 20 cables fire stop sleeves shall be STI EZ-Path series 33.

9. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with UL listed system for firestopping is acceptable. Caulks and sealants shall be manufactured by STI, 3M, Hilti, Nelson, or approved equivalent.

10. Fill ratio for fire stop EMT sleeves shall not exceed 20% fill capacity.

B. Non-Rated Cable Pass-Thru Sleeves

1. Manufacturers: Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:
a. Basis of design: Specified Technologies Inc.
b. Approved equal by:
1) 3M Corporation
2) Hilti Smoke and Acoustic Sleeve
3) Wiremold- Legrand Corporation

2. Non-Rated Cable Pathways: STI EZ-PATH Brand device modules The smoke and acoustical pathway shall contain a built-in sealing system and shall automatically adjust to

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the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall acoustical materials. The following products are acceptable:

a. Specified Technologies Inc. (STI) EZ Path® Series 44 NEZ Smoke and Acoustical Pathway
b. Specified Technologies Inc. (STI) EZ Path® Series 33 NEZ Smoke and Acoustical Pathway
c. SpecSeal® Smoke 'N' Sound Smoke and Acoustical Sealant
    1) SNS120W 20 Oz Sausage - 36 cu in (592 ml)
    2) SNS129W 730573111529 29 Oz Tube - 52 cu in (858 ml)
    3) SNS105W 730573111543 5 Gallon Pail - 1,155 cu in (19.0 L) (White)

3. Horizontal cable pathway locations fewer than 20 cables EMT sleeve with mineral or ceramic fiber stuffing insulation and smoke/acoustical Sealant.

4. Fill ratio for Non-rated EMT sleeves shall not exceed 20% fill capacity.

2.6 GROUNDING

A. Comply with requirements in Division 27 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-C.

2.7 CABLE MANAGEMENT

A. Horizontal Cable Management for Racks or Cabinets

1. Place horizontal cable managers above and below each patch panel in each rack/cabinet. The horizontal cable manager will guide patch/equipment cords between the vertical cable manager and individual network port connections.

2. Provide 2 RMU of horizontal cable management above and below every patch panel. Cables must be able to access the cable manager so that no ports are blocked by the cables.

3. The manufacturer will state estimated cable fills for the cable manager in the product data sheet.

4. The horizontal cable manager will match the rack-mount width of the racks/cabinets.

5. The horizontal cable manager will attach to the front or rear of the rack/frame/cabinet with screws and will be sized to fit within standard EIA-310-D (1-3/4" high RMU) rack-mount spacing. The manufacturer of the horizontal cable manager will sell compatible racks/cabinets.

6. The horizontal cable manager will be a single-sided C-shaped trough with a cover. The single-sided trough will have a slot or holes at the rear to facilitate front-to-rear cabling through the horizontal manager. The front of the cable manager will have T-shaped cable guides along the top and bottom surfaces of the cable manager. Evenly spaced cable openings in between the T-shaped cable guides will allow cables to enter/exit the cable manager into the rack-mount space. The openings will have rounded edges to protect cables. The cover will be removable, hinged to open up or down and will snap on to secure the cover in the closed position.

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7. The horizontal cable manager will be delivered individually boxed, and available in several widths and heights as specified below and in the contract documents.

8. The horizontal cable manager shall be manufactured from sheet aluminum and composite materials.

9. Finish shall be epoxy-polyester hybrid powder coat paint in the color as specified below and in the contract documents. Edge-protectors, T-shaped cable guides and latch hardware is black.
   a. Product: Chatsworth Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30130-719, Universal Horizontal Cable Manager, Single-Sided, 19” Wide x 2 RMU x 5” Deep, Black or approved equal
   b. Product: Chatsworth Products, Inc. (CPI), Universal Horizontal Cable Manager: Part Number 30139-719, Universal Horizontal Cable Manager, Single-Sided, 19” Wide x 1 RMU x 5” Deep, Black or approved equal

2.8 IDENTIFICATION PRODUCTS

A. Comply with ANSI/TIA-606-C and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Division 26 Section "Electrical Identification."

2.9 AV NETWORK SWITCHES

A. Ensure compatibility with the following standards, where applicable:

1. AVB

2. Dante

B. Provide a gigabit, managed switch with the following features:

1. Minimum gigabit ports for inter-switch connections

2. Quality of Service (QoS) with four (4) queues

3. Diffserv (DSCP) QoS, with strict priority

4. If the switch includes Energy Efficient Ethernet (EEE), verify this feature can be disabled. Disable EEE for all ports.

5. IGMP Snooping (with option to enable/disable)

6. Two (2) SFP ports.

C. The switch shall have an internal power supply with an IEC connector. External switching power supplies are not acceptable.

D. Provide a switch with an integrated browser-based user interface.

2.10 AV EQUIPMENT

PART 3 - EXECUTION

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3.1 INSTALLATION

A. General:

1. All installation work shall be in accordance with, but not limited to, this specification and drawings. Work practices shall be performed in accordance with applicable standards, requirements, and recommendations of Federal and Local authorities having jurisdiction.

2. All discrepancies discovered and any discrepancies which are apparent at the date of submission of bids, shall be immediately corrected without additional charge to the Owner.

3. Clearly label all user controls for intended use and nominal setting. These labels shall be engraved and filled, or equal. “Dymo” labels are not acceptable.

4. All equipment shall be rack mounted supplied with the appropriate rack mount kits.

5. Install in each rack enclosure a power distribution panel. Locate power distribution panel in the first available rack unit.

6. All equipment racks to include removable, locking front doors and a 4” diameter, low-noise fan.

7. All rack and instructor stations shall include “security type” screws to secure rack-mounted components.

8. In rooms containing wireless microphones or an assisted listening system, provide an antenna distribution system inclusive of remote antennas as needed to support complete and consistent coverage throughout the space(s).

9. In rooms containing auto-tracking camera systems, provide one (1) day of manufacturer setup and programming.

10. In rooms containing steerable microphones or loudspeakers, provide one (1) day of manufacturer setup and programming.

11. Provide one (1) spare replacement lamp for each projector specified.

B. Physical Installation:

1. Provide system identification plate as shown below. Plate shall occupy the first available rack unit in all AV equipment racks. If more than two (2) racks are positioned together, one (1) plate for every two racks is acceptable. Product: Custom Covid plate # 1LR-CTD-001.

2. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Unless granted specific permission by the Owner, install and secure all boxes, equipment, etc., plumb and square.

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3. Fastenings, mounting brackets and supports shall be adequate to support their loads with a safety factor of at least five (5). A safety chain or cable will be tied to all equipment suspended from above.

4. All motorized projector lifts shall support their loads with a safety factor of at least five (5) and shall be capable of lowering the equipment to a serviceable height (to at least 48" AFF). When retractable to a position flush with the ceiling surface, provide a matching cover in coordination with the architect and ceiling installer. Center lift covers within ceiling elements and minimize impact to room aesthetics.

5. In the installation of equipment, cable, and other elements, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

3.2 AUDIOVISUAL CABLE INSTALLATION

A. All cables, regardless of length, shall be marked with wraparound cable markers at both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on "as-built" drawings and/or run sheets. The labeling and numbering system shall be coordinated with the Owner.

1. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-C.
   a. Cables use flexible vinyl or polyester that flex as cables are bent.

B. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. All wired microphones shall include a 30ft. patch cable with heavy-duty jacket and XLR connectors. Provide local microphone preamp for all wired microphone runs longer than 30ft.

D. Loudspeakers operating at 4/8/16 ohms shall be installed with 12AWG cable as a minimum size/ diameter.

E. Wall plate and floor box input/output panels shall be installed with audio/video line drivers for runs exceeding 35ft.

F. All cabling shall be neatly strapped, dressed, and adequately supported. Any exposed cabling shall be neatly enclosed in a protective covering.

G. Plastic "zip-ties" shall not be used. Cables shall be bundled utilizing plenum rated hook and loop type cable ties.

H. Terminal blocks, boards, strips, or connectors shall be furnished for all cables, which interface, with racks, cabinets, consoles, or equipment modules.

I. AV cabling shall terminate at all floor boxes, wall plates, back boxes, and other infrastructure connection points with patch cables from terminations to source/sink devices (i.e. permanent system cabling may not pass directly through the infrastructure to connect directly to room devices).

J. All audio signal lines shall be balanced at AV I/O plates. Provide ninety (90) degree connector adapters for all AV cabling at custom AV I/O plates.

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K. All cables shall be grouped according to the signals being carried. In order to reduce signal contamination, separate groups shall be formed for the following cables:

1. Power cables
2. RGBHV, Video cables and control cables
3. Data cables
4. Audio cables carrying microphone level signals
5. Audio cables carrying line signals
6. Audio cables carrying amplified loudspeaker level signals

L. Install plenum cable in environmental air spaces, including plenum ceiling.

M. All cables shall be cut to the length dictated by the run plus the required service loop to permit future equipment movement and relocation. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

N. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer. Notify the construction manager if field conditions will interfere with the proper installation of any cables or equipment.

O. Grounding Procedures: In order to minimize problems from improper grounding and to maximize signal-to-noise ratios, adhere to the following grounding procedures:

1. General: Deviate from these practices only when necessary to minimize crosstalk and to maximize signal-to-noise ratios in the audio, video, and control systems. Inform the Consultant in the event that there is a deviation from the standard grounding practices prior to performing the work.
2. Bond the shield of any shielded cable to the grounding busbar in AV rooms and spaces.
3. System Ground: A single “system ground” shall be established for the system. All grounding conductors shall connect to this system ground. The system ground shall be provided in the equipment rack and shall consist of a copper bar of sufficient size to accommodate all secondary ground conductors.
4. A copper conductor, having a maximum of 0.1 Ohms total resistance, shall connect the system ground bar to the nearest grounded, metallic electrical conduit of at least 2 inches in diameter. Be responsible for determining if the metallic conduit is properly electrically bonded to the building ground system and provide a drawing as part of the grounding system documentation indicating the grounding pathway.
5. Secondary system grounding conductors shall be provided from all ungrounded equipment in each area, to the primary system grounding point for the area. Each of these grounding conductors shall have a maximum of 0.1 Ohms total resistance.
6. Under no conditions shall the AC neutral conductor, either in the power panel or in a receptacle outlet, be used for a system ground.

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P. Audio Cable Shields: All balanced audio cable shields shall be grounded at one point only. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.

Q. Video Receptacles: All video receptacles shall be insulated from the mounting panel, outlet box, or wireway.

R. Non-continuous cable supports

1. The AV structured cable shall be supported by its own independent support system.

2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

3. Suspend cable a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.

4. Audiovisual cables shall be supported AFC with adjustable non-continuous cable supports.

5. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of audiovisual cables.

6. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

7. Installation and configuration shall conform to the requirements of the current revision levels of ANSI/ EIA/TIA Standards 568 & 569, NFPA 70 (National Electrical Code), applicable local codes, and the manufacturer's installation instructions.

8. Do not exceed load ratings specified by manufacturer.

9. Follow manufacturer's recommendations for allowable fill capacity for each size non-continuous cable support.

S. Separation from EMI Sources:

1. Comply with BICSI TDMM and ANSI/TIA-569-E for separating AV cabling from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: minimum 5 inches
   b. Electrical Equipment Rating between 2 and 5 kVA: minimum 12 inches
   c. Electrical Equipment Rating More Than 5 kVA: minimum 24 inches

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: minimum 2-1/2 inches
   b. Electrical Equipment Rating between 2 and 5 kVA: minimum 6 inches
   c. Electrical Equipment Rating More Than 5 kVA: minimum 12 inches

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

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a. Electrical Equipment Rating Less Than 2 kVA: No requirement
b. Electrical Equipment Rating between 2 and 5 kVA: minimum 3 inches
c. Electrical Equipment Rating More Than 5 kVA: minimum 6 inches

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: minimum 48 inches

6. Separation between Communications Cables and Fluorescent Fixtures: minimum 5 inches

3.3 REPAIR/RESTORATION

A. Any damage to any installed work or product caused by the unpacking, transporting, assembly, connecting, or configuring of the product shall be repaired at no charge to the Owner.

3.4 FIELD QUALITY CONTROL

A. Once installed and the System Checkout is complete, the system shall be demonstrated as operational to the Owner.

1. If the AV system fails to meet the requirements of this document or those stated by the technical documentation, then the Owner shall reject the installed system and the contractor shall be given notice (either oral or in writing) to correct the failure.

2. If unable to overcome repeated performance deficiencies within thirty (30) days, and if requested to do so by the Owner, remove the equipment and replace at no expense to the Owner.

3. No warranties shall begin until the Owner has authorized final acceptance in writing.

4. Right to Revoke Acceptance: If any equipment and/or goods which have been previously accepted, specifically or by the making of payment, are found to have defects, damage, or deficiencies, or fail to conform to the specification, for any cause not attributable to the Owner, the Owner may revoke acceptance.

B. Conduct pre-acceptance tests

1. Perform all system performance checks on the installed systems prior to final acceptance testing. The Owner / AV Consultant may witness the pre-acceptance tests. The Owner / Architect may inspect and operate system components in order to evaluate installation progress and technical compliance prior to acceptance testing.

C. Contractor System Checkout

1. Perform system checkout before acceptance tests are scheduled. Furnish all required test equipment. Perform all work necessary to determine and/or modify performance of the system to meet the requirements of this specification.

2. During performance testing, all equipment shall be operated under standard conditions as recommended by the manufacturer.

3. Test all audio and video systems for compliance with the Performance Standards using test procedures that follow later in this specification.

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4. Maintain documentation of all performance tests for reference by Consultant during System Acceptance.

5. At the conclusion of the tests, return all equipment settings to previously calibrated positions.

6. Provide written records of all test results in spreadsheet form.

7. Check all control functions, from all controlling devices to all controlled devices, for proper operation.

8. Adjust, balance, and align all equipment to optimize quality and meet the manufacturers' published specifications. Establish and mark normal settings for all level controls and record these settings in the "System Operation and Maintenance Manual."

9. Provide testing results and settings for all equipment and systems to the AV Consultant at least three (3) business days prior to System Acceptance Testing.

10. Provide the AV Consultant with all test results, manuals, software, as-built documentation, etc. prior to acceptance testing.

11. Inform the Owner and AV Consultant that the systems are ready for the AV Consultant to perform System Acceptance Testing. The system shall be considered ready for acceptance testing when the following conditions are met:
    a. AV Contractor has pre-tested all systems such that all sub-systems, functions, software, and equipment are debugged and operational.
    b. AV Contractor has supplied the AV Consultant with the written test results and documentation as listed above for all rooms and systems.
    c. AV Contractor has supplied the AV Consultant with closeout (manuals, training materials, and other as-built) documentation revised to reflect comments and/or revisions arising from the review cycles listed elsewhere within this document.

12. Should the systems not be ready for testing by the AV Consultant at the date(s) and time(s) indicated by the AV Contractor, system acceptance testing may be rescheduled at the sole discretion of the AV Consultant. Pay for the labor and expenses of the AV Consultant and other project team members assembled at the project site for the purpose of system acceptance testing for the date(s) of the original scheduled testing plus the labor and expenses of the AV Consultant and other project team members for the rescheduled testing date(s). The labor rate for the AV Consultant shall be a flat rate of $200.00/hour including travel time. Other project team member labor costs shall be at their respective published rates. The PM and/or Owner shall be entitled to deduct any money owed to the Owner, PM, AV Consultant, or other project team members under this contract from any sum which may become due or is payable to the AV Contractor under this Contract for the purposes of satisfying the charges listed above.

D. Final Acceptance Test

1. Testing will be performed with the Owner (or its designees) present to determine that the AV system equipment satisfies the manufacturers' performance specifications and that the installed AV system satisfactorily performs the functions required by this specification. Conduct formal pre-acceptance tests prior to the Owner's acceptance testing to ensure that the performance and functional specifications are satisfied by the installed system and the system is ready for the Owner's acceptance. Verify in the owner's presence that the installed audiovisual system satisfies the performance and functional requirements through

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formal acceptance testing. Be responsible for staging each room to be tested and shall have sufficient personnel on site to run multiple systems at once (not less than three (3) personnel).

E. Test Equipment

1. Assemble the following test equipment (or equivalent) on site:
   a. Audio and Video cables, terminations, adapters, etc.
   b. Blu-Ray (if applicable)
   c. HDMI/DVI Test Signal Generator
   d. Waveform Monitor
   e. PC/Laptop/Tablet

F. Audio System Testing

1. Absolute Impedances
   a. Set any loudspeaker level controls at zero attenuation. Measure absolute impedance value of each loudspeaker line at 250, 500, 1000, 2000, 4000 Hz without the amplifier connected but with all loudspeakers connected. Impedance must be greater than or equal to the rated load impedance of the respective amplifier. Check the resistance of lines to all loudspeakers and microphone receptacles with the receptacles open and short-circuited.

2. Hum and Noise Level
   a. Test overall hum and noise. System noise should be at least 60 dB below the rated power output of each amplifier with the amplifier controls when set for both full output and for optimal signal-to-noise ratio.

3. Parasitic Oscillation and RF Pickup
   a. Set up the system for each specified mode of operation.
   b. Ensure the system is free of spurious oscillation and RF pickup in the absence of any input signal in each mode of operation and with the system driven momentarily to full output at 160 Hz.

4. Buzzes, Rattles, Distortions
   a. Apply high quality music signal to the system. Adjust the sound system to its maximum usable sound pressure level, and verify clipping is not occurring at any system element.
   b. Apply a sinewave sweep from 50 to 5,000 Hz, 6 dB below full amplifier power.
   c. For both the music and sine sweep sources, listen carefully for buzzes, rattles and objectionable distortion.
   d. Correct all causes of such defects. If the artifact is not caused directly by audiovisual system components, promptly notify the architect indicating cause and suggested corrective procedures.

5. Implement any automated emergency system mute functions required by local regulations.

6. Equalize all audio systems for maximum gain before feedback in all room configurations. Adjust all system inputs for consistent operating levels (within 6dB RMS).

7. Within each audio system, ensure all loudspeakers are installed with the same relative polarity and absolute polarity consistent with each input source device.

8. Verify coverage is consistent throughout audience areas. Adhere to ANSI/INFOCOMM standard 1M-2009, *Audio Coverage Uniformity in Enclosed Listener Areas*. Perform

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separate tests for each audio system in the project and be responsible for modifying or augmenting systems as required to meet the referenced standards.

9. Verify that audio/video synchronization is maintained for all content sources and destinations.

10. Record all system settings and include in the Systems Operation manuals.

G. Video System Testing

1. Signal Paths

2. Utilizing a NTSC color bar generator and waveform analyzer with the video signal set at 100% saturation and 75% amplitude check that the video performance specifications are met at the display devices from all source inputs to all system outputs. Connect the combined waveform monitor/vectorscope to a final output point, e.g. an input to a picture monitor or video projector. Ensure that the test signal is routed to the selected output(s). Level Balance
   a. Adjust all video projection equipment to fill the entire screen area and to produce the best image possible.
   b. Adjust all video sources and displays to produce the best image possible.
   c. Verify that colors appear uniformly on all video displays.
   d. Verify that all pixels operate correctly, consistently meeting or exceeding the manufacturer's specifications. Replace any equipment with pixel failures (dead or excessively bright pixels).
   e. Record all system settings for inclusion in the Systems Operation manuals.

H. RGBHV System Testing

1. For all RGBHV inputs, connect the RGBHV output of the signal generator to a floorbox/table/rack connector and select the SMPTE bar with "pluge pulse" signal at the following computer scan rates:
   a. 1024 x 768 XGA
   b. 1280 x 1024 SXGA
   c. 1366 x 768 WXGA
   d. 1400 x 1050 SXGA+
   e. 1440 x 900 WXGA+
   f. 1600 x 1200 UXGA
   g. 1920 x 1080
   h. 1080i
   i. 1080p
   j. 720i
   k. 720p

2. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector.

3. Repeat items 1 and 2 using Crosshatch, Checkerboard, and H Pattern Signals.

I. Digital Video System Testing

1. For all digital video inputs, connect the output of the digital signal generator to each connection at the following resolutions:
   a. 640 x 480p60 24 MHz Pixel Clock

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b.	1024 x 768p60	63.5 MHz Pixel Clock
c.	1280 x 768p60	68 MHz Pixel Clock
d.	1280 x 768p60	79.5 MHz Pixel Clock
e.	1280 x 1024p60	109 MHz Pixel Clock
f.	1920 x 1080p60 (SMPTE reduced)	148.5 MHz Pixel Clock
g.	1920 x 1200p60 (blanking reduced)	154 MHz Pixel Clock
h.	1600 x 1200p60	162 MHz Pixel Clock
i.	1920 x 1080p60 (VESA)	173 MHz Pixel Clock
j.	1920 x 1080p60 (SMPTE rd.) Deep Color	148.5 MHz Pixel Clock
k.	1280 x 768p60 3D HDTV	
l.	1920 x 1080p24 3D HDTV	
m.	1920 x 1200p75 Deep Color	
n.	2560 x 1600p75	
o.	3840 x 2160p60	
p.	4096 x 2160p30	
q.	4096 x 2160p30 Deep Color	

2. Check that the image is correctly displayed at all system outputs including the monitor(s) and/or by the video projector. Display resolution shall be limited only by the manufacturer specified capabilities of the display or source device. Verify that all display resolutions appear correctly for each system source and destination without artifacts, including but not limited to pixel shift, geometric distortion, letterboxing, pillarboxing, and windowboxing.

3. Focus all images and adjust as required to eliminate any stretching, keystone, or other distortion. In no instance shall an image be mapped or shaped to an unusual surface unless explicitly defined in the project documents. Repeat items 1 and 2 with an HDCP compliant source to all outputs simultaneously to verify compliance.

4. Disable CEC for all source HDMI connections to switchers, scalers or other video processors.

5. Configure or disable EDID as required for consistent, error-free operation.

J. Optical Projection Systems

1. All optical projection systems shall meet the following performance standards:
   a. The total averaged light output from a projector, in lumens, shall be within ±15% of that specified by the projector manufacturer.
   b. The light fall-off from the center of the projected image to all four corners, as measured at the projected image plane, shall not exceed 35%. The light intensity shall be measured at all five positions of the projected image after the projector has been adjusted to provide the light output as specified above.
   c. The “corner” locations shall be defined as the four points determined by intersecting lines drawn 5% of the distance in from the focused edges of the image.
   d. The light meter used for the above measurements shall be properly calibrated foot-candle (or lux) meter and shall be cosine-corrected.
   e. Projectors, lenses, and mirrors shall be solidly mounted and braced so that there will be no observable movement in the image induced by motor vibration or other mechanical operations.

K. Qualification Methods

1. Three methods will be used to qualify the AV system for acceptance.

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a. Inspection - A critical observation of qualifying factors, such as quality of workmanship, equipment placement, routing of cables, adequacy of technical documentation, etc., that do not lend themselves to demonstration or measurement.
b. Demonstration - A process of showing by reason or evidence that a given condition clearly satisfies the requirement.
c. Measurement - A process of determining the actual dimension, capacity, or amount of something, by measuring using calibrated standards.

2. Acceptance of the work of this section shall occur after completion of corrections and adjustments required by “Punch List” (as generated during demonstration and acceptance testing of completed installation).

3. Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to acceptance, without incurring any obligation to accept any equipment or completed systems until punch list work is complete and systems comply with the contract documents.

3.5 SOURCE QUALITY CONTROL CATEGORY RATED CABLING

A. Factory test F/UTP and UTP and optical fiber cables on reels according to ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

B. Factory test F/UTP and UTP cables according to ANSI/TIA-568.2-D.

C. Factory test multimode and singlemode optical fiber cables according to ANSI/TIA-526-14-A and ANSI/TIA-568.3-D.

D. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 CATEGORY RATED CABLING INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated.

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

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6. Cables shall not be painted or exposed to any other building adhesives, paint, coatings, or other foreign agents.

7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

11. In the communications equipment room, install a 10-foot long service loop on each end of cable.

12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. F/UTP and UTP Cable Installation:

1. Comply with ANSI/TIA-568.2-D.

2. Do not untwist F/UTP and UTP cables more than 1/4 inch from the point of termination to maintain cable geometry.

3. Terminate patch panels and outlets to a pin/pair assignment as directed by owner.

D. F/UTP and UTP Patch Cords

1. Provide modular cords required to connect LAN switches to modular jacks on cross connect panel shall be furnished as part of this solicitation. Quantities should be equal to the total number of network outlets. At the Patch panel location provide patch cable lengths as needed for a neat installation utilizing vertical wire managers. At the user outlets provide 10 foot patch cables for each 8 pin modular connector

E. Horizontal Cable Managers

1. When more than one horizontal cable manager is used on a rack/cabinet or group of racks/cabinets, use the same make, and style of cable manager on the rack/cabinet or racks/cabinets.

2. The color of the racks/cabinets and cable managers must match.

3. Attach horizontal cable managers to the rack/cabinet with four screws according to the manufacturer’s installation instructions. Each cable manager should be centered within the allocated rack-mount space (RMU).

4. Horizontal managers will be located so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable manager.

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5. Covers should be attached to the cable manager and in the closed position after cabling is complete.

3.7 FIRESTOPPING CATEGORY RATED CABLING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. General: Install through-penetration firestop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

C. Install EZ Path or EMT sleeve where horizontal cables penetrate a fire rated wall.

D. Manufacturer’s Instructions: Comply with manufacturer’s instructions for installation of firestopping products.

E. Comply with ANSI/TIA-569-E, "Firestopping."

F. Comply with BICSI TDMM, "Firestopping Systems" Article.

G. Any penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be fire-stopped.

3.8 NON-RATED CABLE PASS-THRU SLEEVES

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

B. General: Install through-penetration systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.

C. EZ Path® Series 44 NEZ Smoke and Acoustical Pathway per manufactures instructions

D. EZ Path® Series 33NEZ Smoke and Acoustical Pathway per manufactures instructions

E. Any EMT non-rated wall penetrations created for the passage of telecommunications shall have the annular space filled with mineral wool and Smoke and sound acoustical sealant.

F. Any non-rated EMT wall penetrations created for the passage of telecommunications which remains vacant at the completion of the installation shall be filled with mineral or ceramic fiber stuffing insulation and smoke/sound acoustical sealant.

3.9 GROUNDING CATEGORY RATED CABLING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with requirements in division 27 05 26 “Grounding and Bonding for Communications Systems” for grounding conductors and connectors.

C. Comply with ANSI-J-STD-607-C.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

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3.10 FIELD QUALITY CONTROL CATEGORY RATED CABLING

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect F/UTP and UTP, multi-pair copper and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.2-D and ANSI/TIA-568.3-D.

2. Visually confirm cable category marking of outlets, cover plates, outlet/connectors, and patch panels.

3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test F/UTP and UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.2D. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.3-D. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to ANSI/TIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA-568.3-D.
   c. Optical Time Domain Reflectometer (OTDR) Tests:
      1) Provide OTDR testing for all installed optical fiber links, including all backbone and horizontal links.
      2) Submit OTDR test results to owner upon completion of system installation.

6. F/UTP and UTP Performance Tests:
   a. Test for each outlet. Perform the following tests according to ANSI/TIA-568.2-D:
      1) Wire map.
      2) Length (physical vs. electrical, and length requirements).
      3) Insertion loss.
      4) Near-end crosstalk (NEXT) loss.
      5) Power sum near-end crosstalk (PSNEXT) loss.
      6) Equal-level far-end crosstalk (ELFEXT).
      7) Power sum equal-level far-end crosstalk (PSELFEXT).
      8) Return loss.
      9) Propagation delay.
      10) Delay skew.

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7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to ANSI/TIA-568.3-D.

8. Final Verification Tests: Perform verification tests for F/UTP and UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.
   a. Data Tests: Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

1. End-to-end cabling will be considered defective if it does not pass tests and inspections.

3.11 SCHEDULES

A. [ROOM NAME] ([ROOM NUMBER])

8.

END OF SECTION 27 41 00

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SECTION 27 41 13

MULTIMEDIA SYSTEMS FLOORBOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Multimedia Systems Floorboxes

1.2 PERFORMANCE REQUIREMENTS

A. General: Floor boxes provide interface between power, audiovisual, and telecommunications cabling in concrete floors and decks at workstations or at activation locations requiring power, audiovisual, or communication device outlets.

1. ADA Compliance: Flush-mounted floor device outlets shall not create tripping hazards.

B. Floor Mounted Connector Assembly: Watertight, rubber cable pass thru gasketed door and cover assembly, utilizing basket and connector mounting panel inserts. Customize cover/door opening so that cable pass-thru will accommodate the bundle of AV cabling specified, while maintaining the ability to fully close with cables connected.

C. Labeling: Floor boxes shall bear the “cULus mark” issued by UL for units complying with both US and Canadian Standards.

D. Standards: Comply with the following:

1. UL 514A

2. National Electrical Code

1.3 SUBMITTALS

A. Related Sections

1. Comply with requirements of Section 01 33 00, “Submittal Procedures.”

B. Submittal Data

1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
   a. Cover Sheet
      1) Include name of supplying contractor and project name.
      2) Include submittal and revision number.
   b. Detailed Bill of Materials
      1) Include a listing of: component quantities, equipment manufacturers, model numbers, descriptions of each component being supplied, and the specification paragraphs or drawing sheets that correspond to each product.

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2) The bill of materials shall be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
3) Failure to provide this information will result in the rejection of submittals.

c. Product Data
1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product.
2) Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures.
3) If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight. All optional components and selections shall be clearly indicated.
4) Indicate floor box models, trim, finish, and accessories.

2. Informational Submittals
a. Submit Manufacturer's installation instructions.

3. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.

C. Photographs

1. Submit photographs of each placed floorbox with associated conduit prior to slab pour.

D. Shop Drawings

1. Prior to fabrication submit contractor-generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
a. Title Sheet with sheet index and symbols legend
b. All panels, plates, and designation strips, including connectivity, layout, labeling, and details relating to terminology, engraving, finish and color
c. All unusual equipment modifications
d. Equipment location drawings, dimensioned to column lines
e. Include detailed elevation drawings, showing conduit runs and associated box knockout locations
f. Furniture coordination drawings, depicting planned cable pathway to furniture raceway or outlets, where applicable

2. Drawings should be at project standard scale and clearly legible.

3. Resubmission of contract drawings does not constitute a complete shop drawings submittal and is unacceptable. Such submittals will be rejected.

E. Form

1. Submit all materials for review as described above, specifically referenced to the specification paragraph number (where applicable).
a. Submit all drawings on sheets of one size, preferably the project standard size.
b. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.

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2. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following submittals shall not be considered partial:
   a. Personnel
   b. Milestones
   c. Conduit Verification Statement and Notifications
   d. Rigging and Mounting Drawings
   e. As-Built Documentation

3. Product Data and shop drawings must be submitted together in order to be reviewed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the specified requirements, provide products by one of the following available manufacturers. Manufacturers offering products that may be incorporated into the work include, and are limited to, the following:

1. Legrand/Wiremold
2. Approved equal

B. Multimedia Systems Floorbox:

1. In-slab: EFB8S-OG

2. Raised floor: EFB8S

3. Fire classified: EFB8S-FC

2.2 MATERIALS

A. Door and Cover: Not lighter than 11-gauge steel with integral, self-trimming carpet trim ring. Mount trim ring flush with floor covering. Secure with security socket head screws.

1. Finish: Satin black coating

2. Trim: Door, cover, and integral trim ring shall have radiused corners.

B. Device Plates

1. Provide device plates as detailed on drawings.

2. Provide blank plates for all unused openings.

C. In-slab Boxes

1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep

2. Mount on manufacturer’s backbox.

D. Raised floor Boxes

1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep

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2. Provide toggle clamps to allow box to be secured to raised floors.

E. Fire classified floor Boxes

1. 11-gauge steel, 15 13/16 inches by 12 3/4 inches by 6 1/16 inches deep

2. Provide fire-rated backbox and install per manufacturer's instructions.

3. All boxes shall maintain a minimum of 1 hour of fire rating.

F. Provide pull strings in each conduit at floor box location. Coordinate conduit to box knockout location with telecommunication cabling and audiovisual systems requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The minimum concrete pour depth shall be 7 inches less decking. For pour depths less than 7 inches, provide structural bracing and firestopping as necessary.

B. With Installer present, verify that manufacturer's requirements for floor opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Arrange for jobsite approval of the equipment prior to installation.

B. Verify exact locations of floorbox installation.

C. Coordinate all box locations with furniture onsite prior to installation.

3.3 INSTALLATION

A. Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.

B. Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner which produces a level box with square, plumb, and straight edges.

C. Coordinate installation with floor covering to finish each floor box. Install floor covering with oversized cable management pop-up pass-thru in top, matching surrounding floor covering in cover insert.

3.4 ADJUSTING

A. Adjust door/cover for proper operation.

3.5 PROTECTION

A. Protect installed equipment in original undamaged condition until Substantial Completion. Replace damaged components for units that cannot be repaired prior to Substantial Completion.

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END OF SECTION 27 41 13

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SECTION 282300

VIDEO SURVEILLANCE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Video Surveillance System.
2. Cable connecting hardware, patch panels, and cross-connects.
3. Cable management system.
4. Cabling identification products.
5. Grounding.
6. Pathways.

B. Related Sections
1. 271000 – Telecommunications Structured Cabling
2. 281300 – Access Control Systems

C. System Requirements
1. Provide video surveillance cameras, hardware, head-end equipment, video recorders, power supplies, lightning protection, fiber transceivers, server/client software, licenses, related security hardware as specified and as detailed in associated contract drawings.
2. Integrate system hardware, software, licenses, and locations to provide a full functioning and complete video surveillance system.

1.2 REFERENCES

A. The Codes and Regulations listed below form a part of this specification to the extent referenced. Work shall be performed in accordance with the applicable international, federal, state, and local codes or standards current at the commencement of installation. The following list summarizes applicable standards:
1. UL 294, UL 1076, ULC
2. CE
3. FCC – Part 15, Part 68
4. NFPA 70, NEC
5. IEEE, RS 170 variable standard
6. RoHS

B. Where more than one code or regulation is applicable, the more stringent shall apply.

C. Cable and equipment installation, identification and termination shall be performed in accordance to the applicable codes above.

1.3 DEFINITIONS

A. ADA: Americans with Disabilities Act

B. Bid: Herein, used interchangeably with “proposal”

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C. Demarc: “Demarcation Point” marking the location where communications facilities owned by one organization interface with that of another.

D. DVR: Digital Video Recorder

E. GUI: Graphical User Interface

F. LAN: Local Area Network

G. IP: Internet Protocol

H. IR: Infrared

I. NIC: material and work which is Not In Contract and for which the Installer is not responsible except as otherwise detailed herein.

J. NVR: Network Video Recorder

K. OFE: “Owner Furnished Equipment” which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.

L. OFCI: “Owner Furnished Contractor Installed” Equipment which will be provided by The Owner. Be responsible for installing and integrating this equipment as detailed herein.

M. OSP: Outside Service Plant

N. PoE: Power over Ethernet

O. TR: Telecommunications Room

P. UPS: Uninterruptable Power Supply

Q. The term “shall” is mandatory.

R. The term “will” is informative.

S. The term “should” is advisory.

T. Term “provide” means furnish and install.

U. Security Consultant: Convergent Technologies Design Group, Inc.

V. SMS: Security Management System

W. Bidder: Qualified firm intending to tender a bid on the systems described herein.

X. Construction Manager (CM) or General Contractor (GC): The representative responsible for general building construction and onsite coordination between sub-contractors

1.4 BID PROPOSALS

A. Itemized Bid Response

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1. Each piece of equipment shall be individually priced and submitted with Bid Proposals. Provide itemized bid response to include equipment description, manufacturer, model number, unit price, and quantity. All equipment prices shall reflect required modifications and accessories as needed for a complete and functioning system.
2. Non-equipment charges shall be outlined separately as a single line item. A sum of the video surveillance system total cost shall be provided with the bid proposal.
3. Lump sum bids will not be accepted.

B. Contractor Qualification
1. Demonstrate at least three (3) years experience in the fabrication, programming, assembly, and installation of video surveillance systems of similar magnitude and quality as specified for the subject job. Submit documentation to this effect with the bid response. Be an authorized sales and service center for all listed components and offerings in this specification.
2. Be an Enterprise level dealer of the specified system.
3. Bidders shall include as part of the bid response the following items:
   a. List of all technical personnel factory-certified on specified product manufacturer.
   b. Letter of approval from the manufacturer indicating compliance with qualification requirements.
   c. Installation schedule with proposed manpower assignments.
   d. Resumes for project manager, lead engineer and all ASIS certifications for this project.
   e. Training certificates for design, engineering and installation of the proposed products shall be submitted with the proposal.
   f. Service Dispatch outline containing the type of service program used for dispatching and tracking service calls.

C. Alternate Proposals
1. Any proposed alternate equipment choices should be requested in writing prior to the proposal submission for approval. Each item on the alternate equipment list must be accompanied by catalog cut sheets and technical specifications.

D. Non-Equipment Charges, including but not be limited to:
1. Engineering: Including all required design drawings, run sheets, instruction manuals, console layout, step-by-step user guide, etc.
2. Pre-Installation: Work performed on the Installer’s premises including all fabrication, modification, assembly, rack wiring, etc.
3. Installation: Including all on-site installation and wiring, shop drawing, coordination and supervision, testing, checkout, Owner training, etc., performed on the Owner’s premises.
4. General and Administrative: Including all shipping, insurance, and guarantees.

E. Owner Furnished Equipment (OFE, OFCI)
1. Identify any Owner Furnished Equipment assumed in the Bid Proposal to be installed and integrated under this contract. Identify all assumed Owner Furnished equipment within each room/space type that will be required to complete the video surveillance systems installation.

F. State of the Art Development
1. Supply only the manufacturer’s latest developed product. In cases where product development surpasses the criteria of the specification, inform the Architect and make the newer product available to the project at no additional cost. In no case shall discontinued or obsolete equipment be acceptable. The same requirement applies to software programs developed/updated during the warranty period.

2. Should a manufacturer discontinue a specified product, provide the manufacturer's recommended replacement at no additional cost to the owner. Should the manufacturer have no direct replacement product, propose a product of equal or greater specification from an alternate manufacturer at no additional cost to the owner.
3. Should a product recall by a specified manufacturer require temporary or permanent replacement of a product specified under this section, notify the Architect at the earliest possible time and arrange to replace the product in question as quickly as possible.
    a. Equipment found defective or subject to recall prior to scheduled installation shall not be delivered to the jobsite.
    b. Equipment defect or intended recall shall not relieve the video surveillance contractor from any contractual obligations with regard to delivery schedule of product.
    c. Under no circumstances shall arrangement for alternate product require the Owner to accept superseded equipment except on a temporary basis.

G. Service Contract
1. Submit the costs for a one-year service contract, renewable for up to three years, which shall commence with the completion of the two-year warranty period. These contracts shall be fixed-cost, and can be accepted at the option of the Owner.
2. The service contract shall include all of the services provided during the warranty period, including complete replacement or repair of defective equipment.

1.5 QUALITY ASSURANCE

A. Coordination
1. 281300 for integration requirements of Access Control system components.
2. 271000 for pathways, cabling locations, colors, termination ports, and all OSP Demarc locations related to video surveillance systems.
3. Test and verify structured cabling installed to support the video surveillance system.
4. Coordinate layout and installation of Video Surveillance Systems equipment with Owner's security representative.
    a. Meet jointly with Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
    b. Record agreements reached in meetings and distribute them to other participants and the project Architect for design team distribution.
5. Coordinate this Section with work of other Project Manual sections and associated trades.
6. Specific references, herein, requiring coordination of certain work shall not obviate responsibility for other required coordination.

B. Unspecified Equipment and Material
1. All equipment and materials not specifically addressed on the drawings or in this document and required to provide complete and functional video surveillance system shall be provided in a level of quality consistent with other specified items.

C. Standards and Codes
1. Comply with
    a. Local, state and federal codes
    b. Applicable National Electrical Code
    c. American National Standards Institute
    d. Underwriters' Laboratories, Inc. standards.
2. All equipment, material, accessories, and loose items provided by Contractor shall be new and shall conform to applicable requirements of the above-mentioned agencies.

3. If required by local authorities, provide certificates and labels indicating compliance with above-mentioned codes and standards where applicable.

D. Point of Contact
1. Designate to the Owner in writing, the responsible person who shall ensure timely and consistent communication with the Owner on progress of the contract. The designated representative shall have full knowledge of all engineering and production procedures and shall report status of the installation and upcoming work plans to the Owner's Project Manager and Consultant on a weekly basis.
2. Project manager shall have successfully managed not less than two (2) projects of similar size and scope (as defined in previous sections). Bid submission shall detail the percentage of time that the project manager and other key personnel will be involved with the project.

1.6 SCOPE OF WORK

A. Provide the following in accordance with Specifications and Drawings
1. Submittals delivered in a timely manner as described hereinafter.
2. Verification of dimensions and other conditions at project site. Review conduit system as shown in electrical section of building construction documents and, where applicable, as built conditions. Notify Consultant, Architect, GC, and EC within four weeks after award of contract of any deficiencies or inadequacies in conduit system design.
3. Detailed design of video surveillance system GUI, system "maps," including remote-control accommodations.
4. Power distribution and battery backup within equipment racks including power connection to electrical outlets as described in electrical section of building construction documents.
5. Incidentals necessary for a complete working system.
6. Initial testing and adjustments, demonstration of system for approval, participation in acceptance tests, final adjustments as required.
7. Record Documents, "As-Built" drawings and O&M Manual.
8. Training of operating personnel.
9. Notify appropriate parties of conflicts in a timely manner.
10. Work cooperatively with other trades to resolve conflicts.

B. Special Insurance
1. Provide insurance fully covering all equipment against loss, damage, and theft during shipment, storage, installation, testing, adjustment and demonstration.

1.7 SYSTEM DESCRIPTION

A. All building and room video surveillance systems shall be systems, equipment, and accessories compatible with the current video surveillance system. All auxiliary accessories or supporting devices shall be fully compatible with and able to integrate with existing campus system.

B. Design Intent
1. Provide a complete and functioning video surveillance system inclusive of all hardware, software and training to meet or exceed the performance features outlined in this document.

1.8 SUBMITTALS

A. Related Sections
1. Comply with requirements of Section 01 33 00 - Submittal Procedures.

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B. Submittal Data
1. Submittal data is to be submitted as a complete, single digital file. All documents shall be clearly legible. Each submittal shall contain the below in the following order:
a. Cover Sheet.
1) Include name of supplying contractor and project name.
b. Detailed Bill of Materials.
1) Include a listing of: component quantities, equipment manufacturers, model numbers, and description of each component being supplied, and the specification paragraph or drawing sheet that corresponds to the product.
2) The bill of materials shall include page numbers for each product data sheet and be index referenced within the PDF file so that each product name is clickable, linked to the first page of the corresponding product data.
3) Failure to provide this information will result in the rejection of submittals.
c. Product Data.
1) Include a catalog sheet per product of equipment listed in the Detailed Bill of Materials, in the exact order as the Detailed Bill of Materials. Each catalog sheet shall describe mechanical, electrical and functional equipment specifications. The catalog sheet must also include an image of the product. Photocopy duplications of the manufacturer's original equipment catalog sheets will be allowed as long as they provide adequate clarity of both the printed word and graphics/pictures. If more than one product is shown on the catalog sheet the intended product must be denoted by either an arrow or highlight.
d. Authorized Distributor Certificate.
1) Recently dated (within one year from submittal date) support letter from manufacturer stating that the supplying contractor is an Authorized Distributor of the product being supplied.
e. Partial submittals, or submittals comprised of multiple PDF files, will not be accepted.

C. Shop Drawings
1. Prior to fabrication submit contractor generated drawings for approval for all supplied systems. These drawings shall include, but are not limited to, the following:
a. Title Sheet & Symbols Legend
b. Riser Diagram: Provide riser diagrams of the video surveillance systems and any other systems specified herein.
c. Block Diagrams: Submit block diagrams for each system indicating connections of equipment and indicating equipment types and model numbers.
d. Coordination Drawings: Elevation Details of wall fields in Telecommunications Rooms showing the relationship of rack mounted elements inclusive of Owner provided equipment (labeled as such).
e. All unusual equipment modifications.
f. Front mechanical drawings of each equipment rack.
g. Equipment location drawings.
h. Cable labeling plan.
i. Floor Plans, RCPs and Elevations: Show planned location for all elements and cable routing. Drawings shall be at project standard scale and clearly legible.
j. On submittal drawings, maintain 3/32" minimum lettering height. Submittals with text less than 1/16" in height may be rejected.

D. Form
1. Partial Submittals may be rejected. If submitted individually and each in its entirety, the following Submittals shall not be considered partial:
a. Personnel
b. Milestones

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c. Conduit Verification Statement and Notifications
d. Rigging and Mounting Drawings
e. As-Built Documentation

2. Product Data and Shop drawings must be submitted together in order to be reviewed.

E. Personnel

1. Provide, in writing, within two weeks after award of Contract, the names, mailing address, phone numbers with extensions, email addresses and paging service numbers (if available) of the following project personnel:
   a. Project Manager
   b. Lead Systems Engineer
   c. Field Foreman
2. Within four weeks after award of Contract, submit statement confirming that Contractor has reviewed the conduit system as designed in building construction documents and, where applicable, as built.
3. Notify Consultant, General Contractor, Architect or Electrical Contractor of deficiencies or inadequacies, if any, in conduit system design or installation. If none, so indicate.
4. Absent conduit verification by Contractor and after installation of conduit as designed, Contractor shall assume costs of equipment, materials, labor and engineering, including services of owner's representative(s) in designing and/or verifying revised wiring approach(es) as relate to providing a fully functional system using conduit as designed or as revised at the discretion of the owner.

1.9 CLOSEOUT SUBMITTALS

A. At the completion of the installation, but before Final Acceptance, provide for review and approval the following, in compliance with Division 1 Section *Closeout Procedures*.

1. Operation and Maintenance Manuals:
   a. Equipment manufacturer's operation and service manuals for each make and model of equipment.
   b. System Operation Manual. Produce a manual specifically for the subsystems detailed herein. The manual shall describe all procedures necessary to activate each system to provide for the functional requirements, except as specifically excluded by the Owner. This section shall provide a simple "How-to" users guide for the procedures needed to operate the system. This document shall contain a section on operating the systems equipment in the event of control system failure. Control system touch panel layouts shall be accompanied by narrative text describing "step-by-step" function engagement.

B. Warranty

1. Provide list and dates of activation of equipment warranties
2. Provide original manufacturers' certificates.

C. As-built Drawings

1. Include contractor generated (mark-up of contract documents is not acceptable) digital record diagrams for all systems including, but not limited to:
   a. Schematic wiring diagrams with cable markings.
   b. Internal wiring diagrams of the equipment rack and enclosures.
   c. Custom equipment modifications.
   d. Final test results and nominal settings for all adjustable controls.

D. Software Passwords

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1. Software Passwords Schedule (i.e., a spreadsheet listing the manufacturer, model number and location in the Facility, of each piece of video surveillance equipment, the software for which is password-protected).
2. Provide to Owner's Representative as a secure document separate from Operating and Maintenance Manuals and As-Built Drawings.

E. Laminated Instruction Cards
1. Provide 8 ½ x 11 Instruction cards, approved by the Owner. Laminate step-by-step instructions outlining system operations for the video surveillance system. Provide editable file of card to Owner.

1.10 DELIVERY, STORAGE, HANDLING, AND STAGING

A. Supply, transport, deliver, unload, move to the installation location, unpack, place, assemble, secure, connect, and install all equipment needed to complete the installation. Be responsible for transportation, parking, delivery, and on-site storage of the system's equipment. Be responsible for all transportation of personnel to and from the site.

B. Reconfirm before delivery that hallways, stairways, passages, doorways, rooms, entries, elevators and foyers are of sufficient size to accommodate the passage and installation of the equipment and systems. Off-site pre-staging of goods is encouraged.

C. The Owner's acknowledgment of delivery of goods and any payment made on account of such delivery shall not constitute acceptance (partial or otherwise) and shall not diminish obligations as specified.

D. The actual dates of delivery shall be under the absolute control of the Owner. The dates and times for delivery/installation are critical to the successful completion of the project. Deliveries shall normally be accepted only Monday through Friday 8:00 a.m. to 4:00 p.m. In the event it becomes necessary for goods to be installed outside these hours comply with the instructions of the Owner. Deliveries attempted outside these hours without prior consent of the Owner may be turned away. Comply with all instructions of the Owner and the Contractor concerning time of arrival at the site; which entrance shall be utilized for delivery; routes to be taken to reach the installation location; and other matters relating to the orderly and timely installation of the system.

E. Installation shall commence immediately upon delivery of materials to the jobsite, except as directed by Construction Manager. Time required from delivery date to completion of project shall be in accordance with the approved schedules.

F. Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

G. Do not deliver or install equipment until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.11 SYSTEM TRAINING

A. Training: Provide training in the operation and maintenance of the system for personnel designated by the Owner. Record owner training sessions on DVD or other agreed upon media and make training videos available to the owner at no charge. The training shall be organized as follows:
1. Two (2) two-hour training classes for system technical operation and maintenance. This class shall cover the following topics:

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a. Review of signal flow diagrams.
b. Review of all equipment functions, relevant to the function in this system.
c. Review of initial equipment settings.
d. Demonstration of all functional connections from a user perspective.
e. Review & demonstration of control system software replacement/upgrade procedures.
f. Review of manufacturers' recommended routine maintenance procedures.

2. Four (4) days of advanced user training for systems operations. This shall include day-to-day operation as well as in-depth review of system capabilities and programming.
3. Training may take place at any time (chosen by the Owner) after the systems are operational, up to a year following system acceptance.
4. Close out submittals shall be provided prior to any training classes.
5. Coordinate detailed specifics of the training session(s) time, date & location with the Owner.

1.12 WARRANTY

A. The system warranty shall be for twenty-four (24) months from the date of final acceptance. Provide all equipment, material, and labor required to uphold a full system warranty at no charge to the Owner. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of final acceptance. In the case of modified equipment, the manufacturer's warranty is normally voided. In such cases, provide the Owner with a warranty equivalent to that of the original manufacturer.

B. There shall be no cost to the Owner for maintenance performed during the warranty period beyond the fixed cost of the contract.

C. Provide a total of eight (8) one-day visits per year, or a total of sixty-four (64) engineering/ service labor hours to conduct preventive maintenance and the Owner directed system adjustments.

D. Repair and/or adjust any malfunctioning components located by the technician during this testing. Include software and programming updates / modifications as part of this service contract, providing an updated editable copy of the source code to the Owner.

E. Provide a service telephone number, staffed by a qualified technician familiar with the equipment installed. Staff this number during normal business hours.

F. Respond with an on-site technician within 24-hours of a service call (including Saturdays and Sundays) for all equipment and system failures.

G. Replace or repair, at no cost to the owner, any failed equipment hardware or software installations required to provide full system operations.

H. During the warranty period, advise the Owner in writing each time any routine software and firmware updates become available, giving the Owner the opportunity to upgrade the software/hardware should they so desire at no additional cost. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

I. Provide updates to firmware during service period. Provide any necessary system modifications after installation of these updates to maintain a fully functioning system.

J. The warranty period for any part which has a warranty by the manufacturer of longer than 24 months shall be for the longer period. Provide a copy of the manufacturer's warranty period statement for all major video surveillance system components.

1.13 SERVICE AND MAINTENANCE

A. General Requirements: Provide all services required and equipment necessary to maintain the entire SMS in an operational state as specified for a period of two (2) year(s) after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled service or other unscheduled work.

B. Description of Work: The service and repair of the SMS including all equipment provided under this specification supplied by the contractor. Provide the manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the SMS at its maximum performance.

C. Personnel: Service personnel shall be factory certified in the maintenance and repair of the equipment installed under this section of the specification. The owner shall be advised in writing of the name of the designated service representative, and of any change in personnel.

D. Schedule of Work: This work shall be performed during regular working hours (8-5), Monday through Friday, excluding federal holidays.
   1. Inspections: The Contractor shall perform two minor inspections at 6 month intervals (or more often if required by the manufacturer), and two major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
   2. Minor Inspections: These inspections shall include:
      a. Visual checks and operational tests of all console equipment, peripheral equipment, field hardware, sensors, and electrical and mechanical controls.
      b. Mechanical adjustments if required on any mechanical or electromechanical devices
   3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:
      a. Clean all SMS equipment, including interior and exterior surfaces.
      b. Perform diagnostics on all equipment.
      c. Check, walk test, and if required by the manufacturer's maintenance procedures, calibrate each sensor.
      d. Run all system software diagnostics and correct all diagnosed problems.

E. Operation: Performance of scheduled adjustments and repair shall verify operation of the SMS as demonstrated by the applicable tests of the performance verification test.

F. Emergency Service: The owner will initiate service calls when the SMS is not functioning properly and hinders critical operation of the facility. Qualified personnel shall be available to provide service to the complete SMS repairs. The owner shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at site within four (4) hours after receiving a request for service. The SMS shall be restored to proper operating condition within eight (8) hours after service personnel arrive on site.

G. Work Requests: Separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. Deliver a record of the work performed within 5 days after work is accomplished.

H. System Modifications: Make any recommendations for system modification in writing to the Owner. No system modifications, shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

I. Software: Provide all software updates during the period of the warranty and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with SMS operators, shall include training for the new changes / features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

1.14 COMMISSIONING AND STARTUP

A. Coordinate programming with owner to show all cameras views and camera naming convention are configured to with existing systems per operational guidelines.

B. Provide up to four (4) different client software configurations for owner.

C. Provide facility map as basis for camera locations in software GUI.

PART 2 - PRODUCTS

2.1 SYSTEM

2.2 PRODUCTS AND MANUFACTURERS
1.

2.5 DATA/NETWORK

A. Data transmission cable.
1. All video surveillance system copper and optical fiber data wiring, cables, jumpers, and connectors per Section “27 10 00 Telecommunications Structured Cabling” construction standards.

2.6 LIGHTNING PROTECTION MODULE

A. Provide Lightning Protection Module at all exterior camera locations. Basis of design shall be Ditek model DTK-MJRPOE.

2.7 MOUNTING EQUIPMENT

A. All video surveillance cameras housings and mounts adequate to provide protection against accidental and intentional damage or tampering. Torx center pin security fasteners shall be used on devices in public areas.

B. All video surveillance camera housings and mounts shall have adequate housings and environmental controls to ensure proper operation of camera as determined by environmental conditions and building usage.

2.8 DATA TRANSMISSION RESOURCES NEEDS

A. Data cable runs shall be limit to no more than 290 ft from the camera device and switch. During design and installation close attention must be paid to the distance of cabling runs for video surveillance.

B. Camera installations at remote exterior locations shall use 6-strand OM4 MM optical fiber with Media Converter Pole Mounted Cabinet to transmit video signals to the Telecommunications rooms.

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PART 3 - EXECUTION

3.1 GENERAL DESIGN STANDARDS

A. Video surveillance systems shall be designed and installed to not interfere with egress requirements for life safety nor interfere with intrusion or fire alarm systems.

B. All video surveillance installations shall use housings and mountings which maintain or minimize disruption to architectural sensibilities or themes of the building and exterior areas.

C. All video surveillance installations shall use housings and mounting designed to provide sufficient protection against tampering and vandalism. Torx center pin security fasteners shall be used on all devices installed in public areas.

D. All equipment and components to support video surveillance system shall be installed to manufacturer's specifications. Installation of components and hardware shall be in place prior to connection to the video surveillance system.

E. All video surveillance system equipment, including controllers and power supplies, shall be located in accessible and secure rooms.

3.2 CONDUCTORS, WIRE, CABLES

A. Data
1. All video surveillance system data wiring, cables, jumpers, and connectors will comply with requirements of Section 27 01 00 Communication construction standards.

B. Low Voltage Electrical
1. All video surveillance system low voltage electrical wiring, cables, and connectors will comply with the requirements of Section 27 01 00 Communication construction standards.

3.3 INSTALLATION

A. Install all products in this section following the product manufacturer's published installation and application manuals and guidelines.

B. Install system according to manufacturer's written instructions.

C. Systems Integration:
1. Develop, install, and test software and databases for complete and proper operation of systems involved.
2. Setup and program entire system such that no additional programming is required including setup all available software features.
3. Perform a full system back-up at completion of initial programming and deliver configuration to Owner.
4. Perform field software changes after the initial programming session to "fine tune" operating parameters and sequence of operations based on revisions to the Owner's operating requirements.

D. Test equipment and configure system in accordance with instructions provided by manufacturer prior to installation.

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E. Provide products with latest and most up-to-date firmware by manufacturer or provide firmware of a version as specified by provider of Video Management Appliance (VMA) or Network Video Recorder (NVR).

F. Review configurable features of device with Owner's Representative and establish a punch list for standard, device specific, location specific and SMS specific configuration of device(s).
   1. Program and configure devices in accordance with this punch list so no additional programming is required for operation by user.

G. Configure equipment requiring users to log on using a password with user/site-specific credentials. Default passwords are not acceptable and must be configured prior to project closeout.

H. Provide products with the latest and most up-to-date firmware by the manufacturer or provide firmware of a version specified by the provider of the Video Management Application (VMA) or Network Video Recorder (NVR).

3.4 VIDEO SURVEILLANCE ADMINISTRATION

A. Administration of the video surveillance infrastructure includes documentation of devices, cables, termination hardware, patching and cross-connection facilities, conduits, other cable pathways, and telecommunications closets.

B. All video surveillance cameras, devices, and cables shall be clearly marked using permanent means. Video cameras shall use the following system of numbering
   1. Exterior Cameras Mounted Viewing Building Entrance: Abbreviated building name + EXT + number of door + abbreviated compass direction of door relative to the center of the building. Example DBPS EXT 27 NW (if more than one camera at entrance for the same purpose include decimal designator to number of door).
   2. Exterior Camera Mounted to Building Viewing Parking Lot: Abbreviated building name + LOT + number of parking lot + abbreviated compass direction of door relative to the center of the parking lot. Example DBPS LOT R10 S.
   3. Exterior Camera Mounted to Building Viewing Area Around Building: Abbreviated building name + EXT + abbreviated name of area covered + abbreviated compass direction of area viewed relative to the center of the area viewed. Example DBPS EXT 27 NW (if more than one camera at entrance for the same purpose include decimal designator to name of area covered).
   4. Exterior Camera Mounted Light Pole Viewing Area: Abbreviated name of area viewed + EXT + abbreviated building name of nearest building + abbreviated compass direction of area viewed relative to the center of the area viewed. Examples EXT JCK E.
   5. Exterior Camera Mounted to Light Pole Viewing Parking Lot: LOT + number of parking lot + abbreviated compass direction of area viewed relative to the center of the parking lot. Example LOT R5 SW.
   6. Interior Camera Mounted Viewing Building Entrance: Abbreviated building name + INT + Floor + number of door + abbreviated compass direction of door relative to the center of the building. Example DBPS INT 1st 27 NW (if more than one camera at entrance for the same purpose include decimal designator).
   7. Interior Camera Mounted Viewing Interior Room: Abbreviated building name + INT + number of room. Example DBPS INT 202 (if more than one camera at entrance for the same purpose include a decimal designation at end of sequence. Example DBPS INT 202.1).
   8. Interior Camera Mounted Viewing Interior Area: Abbreviated building name + INT + Floor + Abbreviated name of area viewed. Example DBPS INT 1st Lobby (if more than one

camera used for the same area include a decimal designator. Example DBPS INT 10th Hallway.1).

9. Power Supply: PWR + abbreviated installed location/building + number of room installed - number. Example PWR JCK INT 202-1.

3.5 RECORDS

A. Records must be maintained in a spreadsheet, or in a database. A device and cable record is prepared for each installed camera. The record will show the device name and must describe the components from origin point and destination point.

3.6 DRAWINGS

A. Provide drawings to illustrate different stages of video surveillance system installation planning, installation, and administration.

B. Installation or Construction Drawings
1. Installation or construction drawings are the plans that show the installer how the infrastructure and devices are to be installed. The quality of the installation can be directly impacted by the level of detail in the installation drawings and written specifications. Installation drawings shall show, cabling pathway locations and routing and number of components.

C. As-built Drawings
1. The as-built drawings graphically document the installed video surveillance infrastructure through floor plan, elevation, and detail drawings. These drawings will differ from the installation drawings because of changes made during construction and specific site conditions. In the as-built drawings, the identifiers for major infrastructure components must be recorded. The pathways, spaces, and wiring portions of the infrastructure each may have separate drawings if warranted by the complexity of the installation, or the scale of the drawings. As- built drawings must be kept current as adds, moves, and changes take place.

3.7 LABELING

A. Labeling applied to all video surveillance devices, wiring, and infrastructure components. Labeling with the unique identifier will identify a particular component.

B. Labeling
1. Labels either adhesive or insert type. All labels must be legible, resistant to defacement, and maintain adhesion to the application surface.
2. Outside plant labels shall be totally waterproof, even when submerged.
3. All labels shall be machine printed.
4. Labels applied directly to a cable shall have a clear vinyl wrapping applied over the label and around the cable to permanently affix the label.
5. Other types of labels, such as tie-on labels, may be used. However, the label must be appropriate for the environment in which it is used and must be used in the manner intended by the manufacturer.

3.8 CLOSEOUT ACTIVITIES

A. Demonstration:
1. Demonstrate administration and operation of devices described by this section.

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2. Demonstrate how to authorize users and applications to operate and configure installed devices.
3. Demonstrate how an authorized user can gain access to and make changes to configuration.
4. Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

B. Fine Tuning:
1. Perform field software changes after initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to Owner’s operating requirements.

C. License Assignment:
1. Register software, hardware, firmware, operational or administrative licenses necessary to operate or administer devices to Owner.
2. Deliver to Owner’s Representative proof of license registration from product manufacturer.

D. Device Configuration Backup:
1. Using manufacturer’s backup software tool, perform a full system back-up at completion of initial programming.
2. Deliver configuration backup files, restoration application and instructions detailing for restoration of back-up configuration.

END OF SECTION 282300

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SECTION 284621.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Existing fire-alarm system to be modified.
2. Addressable fire-alarm system.
3. Fire-alarm control unit (FACU).
4. Manual fire-alarm boxes.
5. System smoke detectors.
6. Duct smoke detectors.
7. Fire-alarm notification appliances.
8. Fire-alarm remote annunciators.
9. Fire-alarm addressable interface devices.

1.2 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. FACU: Fire-alarm control unit.

C. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.3 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. When new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.4 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Annunciator panel details as required by authorities having jurisdiction.
5. Detail assembly and support requirements.
6. Include voltage drop calculations for notification-appliance circuits.
7. Include battery-size calculations.
8. Include input/output matrix.
9. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
10. Include performance parameters and installation details for each detector.
11. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
12. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring and equipment required for HVAC unit shutdown on alarm.
    c. Locate detectors in accordance with manufacturer's written instructions.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Qualification Statements: For Installer.

C. Sample Warranty: Submittal must include line item pricing for replacement parts and labor.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On USB media, approved online or cloud solution.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.

2. Installation must be supervised by personnel certified by NICET as fire-alarm Level III technician.
3. Obtain certification by NRTL in accordance with NFPA 72.
4. Licensed or certified by authorities having jurisdiction.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXISTING FIRE-ALARM SYSTEM TO BE MODIFIED

A. Basis for Pricing: Notifier (AFP-400)

B. Description: Intelligent, addressable, voice evacuation system.

C. Source Limitations for Fire-Alarm System and Components: Components must be compatible with, and operate as extension of, existing system. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.

2.2 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice-and-strobe notification for evacuation.

B. Performance Criteria:

1. Regulatory Requirements:

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics:

a. Automatic sensitivity control of certain smoke detectors.
b. Reference *associated drawings* for specific sequence of operations.

c. Document Storage Box:

1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system

information. Provide two key ring holders with location to mount standard business cards for key contact personnel.

2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.
3) Color: Red powder-coat epoxy finish.
4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.
5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.3 FIRE-ALARM CONTROL UNIT (FACU) – EXISTING TO REMAIN

A. Existing manufacturer: Notifier

B. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

C. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.

a. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1) Pathway Class Designations: NFPA 72, Existing to be maintained.
2) Pathway Survivability: Existing to be maintained.
3) Retain first subparagraph below if the number of devices on signaling-line circuits is not indicated on Drawings. See Editing Instruction No. 3 in the Evaluations for discussion about determining the number of addressable devices on a signaling-line circuit.
4) Install no more than 80% addressable devices on each signaling-line circuit.

2.4 MANUAL FIRE-ALARM BOXES

A. Shall be compatible with existing FACU.

B. Shall match existing color, type, series, etc. station.

C. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

2.5 SYSTEM SMOKE DETECTORS

A. Shall be compatible with existing FACU.

B. Shall match existing color, type, series, etc. station.

2.6 DUCT SMOKE DETECTORS

A. Shall be compatible with existing FACU.

B. Shall match existing color, type, series, etc. station.

2.7 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Voice/Tone Notification Appliances:

(a) Shall be compatible with existing FACU.

(b) Shall match existing color, type, series, etc. station.

B. Fire-Alarm Visible Notification Appliances:

(c) Shall be compatible with existing FACU.

(d) Shall match existing color, type, series, etc. station.

2.8 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Shall be compatible with existing FACU.

B. Shall match existing color, type, series, etc. station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service in accordance with requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Protection of In-Place Conditions: Protect devices during construction unless devices are placed in service to protect facility during construction.

3.3 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.
2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Connect new equipment to existing control panel in existing part of building.
2. Connect new equipment to existing monitoring equipment at supervising station.
3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to new points. New components must be capable of merging with existing configuration without degrading performance of either system.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.
2. Mount manual fire-alarm box on background of contrasting color.
3. Operable part of manual fire-alarm box must be between 42 and 48 inch above floor level. Devices must be mounted at same height unless otherwise indicated.

D. Smoke Detector Spacing:

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Smooth ceiling spacing must not exceed 30 ft.
3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex B in NFPA 72.
4. HVAC: Locate detectors not closer than 36 inch from air-supply diffuser or return-air opening.
5. Lighting Fixtures: Locate detectors not closer than 12 inch from lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

H. Audible Alarm-Indicating Devices: Install not less than 6 inch below ceiling. Install bells and horns on flush-mounted back boxes with device-operating mechanism concealed behind grille. Install devices at same height unless otherwise indicated.

I. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inch below ceiling. Install devices at same height unless otherwise indicated.

J. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate must be laminated acrylic or melamine plastic signs with black background and engraved white letters at least 1/2 inch high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.

3.6 PATHWAYS

A. Raceway and wiring shall match existing building standard.

3.7 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

1. Smoke dampers in air ducts of designated HVAC duct systems.
2. Electronically locked doors and access gates.
3. Alarm-initiating connection to elevator recall system and components.
4. Alarm-initiating connection to activate emergency lighting control.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt-trip breaker.
8. Data communication circuits for connection to building management system.
9. Data communication circuits for connection to mass notification system.
10. Supervisory connections at fire-pump power failure including dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.8 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in location visible from FACU.

3.9 FIELD QUALITY CONTROL

A. Field tests must be witnessed by authorities having jurisdiction.

B. Administrant for Tests and Inspections:

1. Owner will engage qualified testing agency to administer and perform tests and inspections.
2. Engage qualified testing agency to administer and perform tests and inspections.
3. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.
4. Administer and perform tests and inspections with assistance of factory-authorized service representative.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
4. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.
5. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.
6. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Provide video recording of training to Owner or Allow Owner to record training.

3.11 MAINTENANCE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections in accordance with "Visual Inspection Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in "Test Methods" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per "Testing Frequencies" table in "Testing" paragraph of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.12 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement must include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software must include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

END OF SECTION 28 46 21.11

ATTACHMENT J.3

DLS GEOTECHNICAL REPORT

To be issued via addendum.

ATTACHMENT K

PROJECT SCHEDULE

To be issued via addendum.

ATTACHMENT L

SAMPLE CONTRACT

To be issued via addendum.

ATTACHMENT M

MBE SEARCH FACTORS

Attachment M: MBE Research Factors

Solicitation Title: Testing and Inspection Services – Arthur Perdue Stadium Improvements

This exhibit serves as a summary of the factors the State used, in conjunction with guidance from the Governor's Office of Small, Minority, and Women's Business Affairs, to determine:

1. *The expected degree of Minority Business Enterprise (MBE) participation for the procurement contract, including subcontracting opportunities identified for the project, any applicable North American Industry Classification System (NAICS) codes linked to the subcontracting opportunities, and the number of certified MBEs in those industries;*

2. *The expected degree of Veteran-owned Small Business Enterprise (VSBE) participation for the procurement contract, including subcontracting opportunities identified for the project, any applicable United Nations Standard Products and Services Codes (UNSPSC) [identified in eMaryland Marketplace Advantage (eMMA) as Categories] linked to the subcontracting opportunities, and the number of certified VSBEs in those industries; and*

3. *If this procurement is for a Statewide Master Contract where secondary competition may occur, the expected degree of Small Business Reserve (SBR) participation for the secondary competition agreement (such as a task order agreement or purchase order agreement) to be designated as an SBR, including opportunities identified for the secondary competition agreement, any applicable UNSPSCs linked to the subcontracting opportunities, and the number of certified SBRs in those industries.*

Disclaimer: *This summary's research results are not all inclusive and do not exclude any other subcontracting opportunities that the Bidder/Offeror may identify in preparing a Bid/Proposal to submit in response to the solicitation.*

Attachment M: MBE Research Factors

MBE Research by NAICS Code		
NAICS Codes	**Description**	**# MBEs in MDOT Directory**
541330	Engineering Services	519
541380	Testing Laboratories	89
MBE Research by Keywords		
Keywords		**# MBEs in MDOT Directory**

ATTACHMENT N

PRIME CONTRACTOR'S LIST OF ALL SUBCONTRACTORS

Attachment N Prime Contractor List of ALL Subcontractors Anticipated/Used During Contract

July 2024

Effective beginning for Fiscal Year (FY) 2023, the State of Maryland is required to collect the names and total payments of all subcontractors used during the life of the contract with no regard to socioeconomic program status or certifications. Provide a State of Maryland certification number for firms that do hold MBE, VSBE, and/or SBR certifications, regardless of whether they are fulfilling subcontracting program goals. It should be noted in the appropriate column if the firm is fulfilling a specific subcontracting goal.

Attachment P is required to be submitted with the bidder/offeror's bid/proposal whenever there is a MBE and/or VSBE participation goal(s) included in the solicitation.

Attachment P will be used during the life of the contract to track Subcontractors working for the Prime with a final report of all subcontractors and payments made to the subs regardless of their socioeconomic program status.

Instructions on How to Complete Attachment N

1. There are two spreadsheets/tabs in Attachment N - "Anticipated Subcontractors" and "Actual Subcontractors".
2. The first tab - "Anticipated Subcontractors" is to be completed and submitted with the bid/proposal.
3. The following information must be filled out at the top of the first spreadsheet prior to submitting the attachment with the bid/proposal:
   A. Bidder/Offeror Name: (Bidder/Offeror's Company Name responding to the solicitation)
   B. Agency and Program Name: (State Agency/Program that published the solicitation named on both the cover page and the Key Information Summary Sheet)
   C. Solicitation Name / Number: (Solicitation Name and Number found on the cover page of the solicitation and the Key Information Summary Sheet)
   D. Overall MBE % Goal for Contract: (The total MBE participation goal for the contract identified on the Key Information Summary Sheet)
   E. Overall VSBE % Goal for the Contract: (The total VSBE participation goal for the contract identified on the Key Information Summary Sheet)
   F. Contract Duration: (Contract duration identified in the Key Information Summary Sheet)
   G. Bidder/Offeror Signature: (The Bidder/Offeror's representative with the power to sign a State of Maryland contract and affirm the statement below:)
   "By my signature above, I affirm that the list below contains all currently known anticipated subcontractors that will be used to fulfill the contact requirements."
4. The following information must be filled out in the body of the first spreadsheet for all known subcontractors prior to submitting the attachment with the bid/proposal:
   A. Subcontractor Name (The Subcontractor Company's Name that has an agreement with the Prime to work on the contract)
   B. MBE/VSBE/SBR - State of Maryland Certification # or NA (If the Subcontractor is a MBE, VSBE, or SBR list their Maryland certification number found on their eMMA profile or MDOT MBE
   C. Brief Description of Work to be Performed (For MBEs and VSBEs, ensure the work being identified is work they are certified to perform) *
   D. Individual MBE/VSBE % Goal or NA (If you are utilizing more than one MBE or VSBE to meet the overall goals identified at the top of the spreadsheet, enter the percentage that this particular

**** NOTE: Any MBE or VSBE named and listed on this spreadsheet must also be listed on the MBE Forms - Attachment D or VSBE Forms - Attachment E required to be submitted with the***

The State is aware that circumstances change during the course of a contract that requires subsitutions among subcontractors. Thus, this second tab of the form is to capture all subcontractors actually utilized during the life of the contract. For example, if you modified the contract to add or change a MBE or VSBE from the original named MBE(s) or VSBE(s), or added any subcontractors, including MBE, VSBE, SBR certified firms that were not fulfilling a subcontracting goal.

5. The second tab - "Actual Subcontractors" is to be completed and submitted as required by the procurement officer and/or contract monitor/project manager during the contract performance period with
6. The following information must be filled out at the top of the second spreadsheet prior to submitting the attachment when requested and at contract close out:
   A. Prime Contractor Name: (Bidder/Offeror Awarded the Contract that performed as the Prime Contractor)
   B. Agency and Program Name: (Copied from the first spreadsheet)
   C. Contract Name / Number: (Copied from the first spreadsheet)
   D. Overall MBE % Goal for Contract: (Copied from the first spreadsheet)
   E. Overall VSBE % Goal for the Contract: (Copied from the first spreadsheet)
   F. Contract Term (Start Date - End Date): (The actual start and end dates of the Contract)
   G. Total Amount Invoiced to/Paid by the State to the Prime Contractor: (Total amount paid to the Prime Contractor by the State)
   H. Prime Contractor Signature: (The Contractor's representative with the power to sign a State of Maryland contract and affirm the statement below:)
   "By my signature above, I affirm that the list below contains all subcontractors that were used to fulfill the contact requirements and the total amount paid to each subcontractor to close out the contract."
7. The following information must be filled out in the body of the second spreadsheet for all subcontractors that worked on the contract during the time period requested and at contract close out:
   A. Subcontractor Name (The Subcontractor Company's Name that has an agreement with the Prime to work on the contract)
   B. MBE/VSBE/SBR - State of Maryland Certification # or NA (If the Subcontractor is a MBE, VSBE, or SBR list their Maryland certification number found on their eMMA profile or MDOT MBE
   C. Brief Description of Work to be Performed (For MBEs and VSBEs, ensure the work being identified is work they are certified to perform) *

D. Individual MBE/VSBE % Goal or NA (If you are utilizing more than one MBE or VSBE to meet the overall goals identified at the top of the spreadsheet, enter the percentage that this particular

E. Total $$ Paid to Subcontractor (Total amount invoiced by the Subcontractor and paid by the Prime to the Subcontractor during the life of the contract with the State of Maryland) **

***** NOTE: Any MBE or VSBE named and listed on this spreadsheet must also be listed on the MBE Forms - Attachment D or VSBE Forms - Attachment E submitted with the bid/proposal or by***

8. These spreadsheets are not protected, so you many modify the forms to enter the information required and add rows as needed for additional subcontractors.

Prime Contractor List of Subcontractors Anticipated to Use During Contract

(MBE and VSBE subcontractors are contractually obligated by the prime contractor from the bid/proposal submission and contract award.)

Bidder/Offeror Name:	
Agency and Program Name:	
Solicitation Name / Number:	
Overall MBE % Goal for Contract:	
Overall VSBE % Goal for the Contract:	
Contract Duration:	
Bidder/Offeror Signature:	

By my signature above, I affirm that the list below contains all currently known anticipated subcontractors that will be used to fulfill the contact requirements.

Subcontractor Name	MBE/VSBE/SBR State of Maryland Certification # or	Brief Description of Work to be Performed	Individual MBE/VSBE % Goal or NA

Prime Contractor List of Actual Subcontractors Used During Contract

(MBE and VSBE subcontractors are contractually obligated by the prime contractor from the bid/proposal submission and contract award.)

Prime Contractor Name:	
Agency and Program Name:	
Contract Name / Number:	
Overall MBE % Goal for Contract:	
Overall VSBE % Goal for the Contract:	
Contract Term (Start Date - End Date):	
State to the Prime Contractor:	
Prime Contractor Signature:	

By my signature above, I affirm that the list below contains all subcontractors that were used to fulfill the contact requirements and the total amount paid to each subcontractor to close out the contract.

Subcontractor Name	MBE/VSBE/SBR State of Maryland Certification # or	Brief Description of Work to be Performed	Individual MBE/VSBE % Goal or NA	Total $$ Paid to Subcontractor